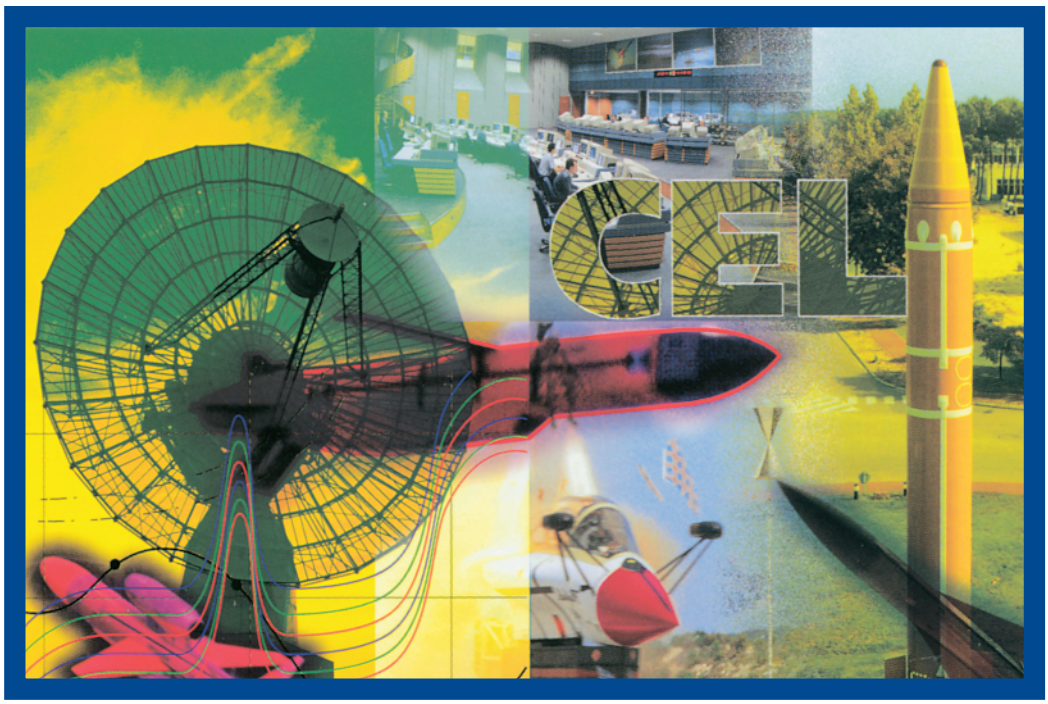
NORTH ATLANTIC TREATY ORGANIZATION

RESEARCH AND TECHNOLOGY ORGANIZATION

BP 25, 7 RUE ANCELLE, F-92201 NEUILLY-SUR-SEINE CEDEX, FRANCE

HIGHLIGHTS 2000



Published May 2001

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (FROM - TO)
01-05-2001		xx-xx-2001 to xx-xx-2001

4. TITLE AND SUBTITLE
RTO Highlights 2000
Unclassified

5a. CONTRACT NUMBER
5b. GRANT NUMBER
5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

5d. PROJECT NUMBER
5e. TASK NUMBER
5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME AND ADDRESS
Research and Technology Organization
North Atlantic Treaty Organization
BP 25, 7 rue Ancelle, F-92201 Neuilly-sur-Seine Cedex
xxxxx, Francexxxxx

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME AND ADDRESS
NATO Research and Technology Organization
BP25, Rue Ancelle
F-92201 Neuilly-Sur-Seine, Cedex
xxxxx, Francexxxxx

10. SPONSOR/MONITOR'S ACRONYM(S)
11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
APUBLIC RELEASE
,

13. SUPPLEMENTARY NOTES

14. ABSTRACT
The main purpose of ?Highlights?, RTO?s ?house magazine?, is to help to bind together members of the RTO ?Family?. To this end, it publishes articles judged to be of general interest to the defence R&T community, as well as information about members of the Family. Articles may be based on presentations to the Board or Panel meetings, or may be original work submitted by individuals. The latter are especially welcome.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE	Public Release	60	Fenster, Lynn lfenster@dtic.mil
Unclassified	Unclassified	Unclassified			19b. TELEPHONE NUMBER International Area Code Area Code Telephone Number 703767-9007 DSN 427-9007

The Research and Technology Organization (RTO) of NATO

RTO is the single focus in NATO for Defence Research and Technology activities. Its mission is to conduct and promote cooperative research and information exchange. The objective is to support the development and effective use of national defence research and technology and to meet the military needs of the Alliance, to maintain a technological lead, and to provide advice to NATO and national decision makers. The RTO performs its mission with the support of an extensive network of national experts. It also ensures effective coordination with other NATO bodies involved in R&T activities.

RTO reports both to the Military Committee of NATO and to the Conference of National Armament Directors. It comprises a Research and Technology Board (RTB) as the highest level of national representation and the Research and Technology Agency (RTA), a dedicated staff with its headquarters in Neuilly, near Paris, France. In order to facilitate contacts with the military users and other NATO activities, a small part of the RTA staff is located in NATO Headquarters in Brussels. The Brussels staff also coordinates RTO's cooperation with nations in Middle and Eastern Europe, to which RTO attaches particular importance especially as working together in the field of research is one of the more promising areas of initial cooperation.

The total spectrum of R&T activities is covered by the following 7 bodies:

- AVT: Applied Vehicle Technology Panel
- HFM: Human Factors and Medicine Panel
- IST: Information Systems Technology Panel
- NMSG: NATO Modelling and Simulation Group
- SAS: Studies, Analysis and Simulation Panel
- SCI: Systems Concepts and Integration Panel
- SET: Sensors and Electronics Technology Panel

These bodies are made up of national representatives as well as generally recognised 'world class' scientists. They also provide a communication link to military users and other NATO bodies. RTO's scientific and technological work is carried out by Technical Teams, created for specific activities and with a specific duration. Such Technical Teams can organise workshops, symposia, field trials, lecture series and training courses. An important function of these Technical Teams is to ensure the continuity of the expert networks.

RTO builds upon earlier cooperation in defence research and technology as set-up under the Advisory Group for Aerospace Research and Development (AGARD) and the Defence Research Group (DRG). AGARD and the DRG share common roots in that they were both established at the initiative of Dr Theodore von Kármán, a leading aerospace scientist, who early on recognised the importance of scientific support for the Allied Armed Forces. RTO is capitalising on these common roots in order to provide the Alliance and the NATO nations with a strong scientific and technological basis that will guarantee a solid base for the future.

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Published May 2001

Printed by St. Joseph Ottawa/Hull
(A St. Joseph Corporation Company)
45 Sacré-Cœur Blvd., Hull (Québec) Canada J8X 1C6

Highlights 2000

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To ensure that this publication continues, we need your help. Please send contributions, which may be of technical, scientific, military, or management matters, information about members of the family who have done something notable or received a prestigious award or (regrettably) have died, or light-hearted items for inclusion in the final section – 'This Really is the End'. Contributions may be in English (British and American spelling are both acceptable) or in French.

Please send your items to:

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RTO Web Site

Please visit this at **www.rta.nato.int**, and send us your comments
(to webmaster@rta.nato.int)

★ ★ ★

Cover picture:

A montage representing the activities of the Centre d'Essais des Landes in France, which the Board visited during its Spring 2000 meeting. A photographic report of the visit to the Centre is given elsewhere in this issue.

The Editor (who has now retired) wishes to apologise for the extremely late publication of this issue of Highlights. The fault is entirely his.

Click inside the blue boxes to view the corresponding section

Highlights 2000

Contents

A Note from the Director . . .
My Hopes for the Future . . .

Having spent a bit less than two months* in the RTA Director's chair, this is not the time to tell you all that I know about the RTA. It is, however, a good time to talk a little about my hopes. These hopes are both personal and institutional.

First let me say how happy and excited I am to be here. To be associated with the RTA and to live in Paris is something which makes me feel like the luckiest person in the world. My wife and children feel the very same way. My wife said to me just before we moved to France, "Ken, I think that this is the very best thing that has ever happened to me in my entire life!" It's true, and we hope to make the very most of our stay in Europe. Our experience to date has confirmed our hopes for we have been welcomed warmly into the community and we have been thrilled by our exposure to France in the little bit of travelling we have done to date. We want to immerse ourselves as much as humanly possible in the life of this country, for we know that the time will pass quickly and that such an opportunity is rare.

Our personal life is just one aspect of the good fortune we feel. Equally important is the fact that for three years I will be associated with the NATO RTO as Director of the RTA. I feel the honour strongly. My association with the predecessor organisations goes back a long way; I knew them fairly well, and I was very much involved in their transition to the new structure we know today as the RTA. To now have the chance to be associated with the agency and to be able to have some influence in how we move ahead in R&T is wonderful. The RTA has a long and proud background. It is staffed by people from many of the Alliance nations, and they are carrying this strong history forward because they are capable and they are very caring of the job they do and the results we produce. Our job here at the RTA is to support both the Board and the network of national contributors to the RTO, and I can assure you that we all want to provide you with the very best support possible.

The technical programme of the RTO is our life blood; for the past several years we have necessarily been heavily involved in process, for the restructuring has required much attention to process. We have now reached the stage where what we are doing should assume its proper place, ahead of how we do it. By no means can we forget process, I simply mean that our technical contributions to both NATO and the Nations must now re-enter the limelight. Again, our job at the RTA is to ensure that this happens. We exist to help bring technology issues and concerns to the foreground for military planners and operators, not to be a bureaucratic stumbling block and rule enforcer. Everyone at the RTA knows this and works to this end.

In a very few years, RTO has become recognised in NATO and the Nations as a very valuable tool, and I intend to build on this strong foundation to make it even better in the future.

*Editor's note: The Director wrote this article in late August 2000, but the editor did not ask him to revise it nearer the publication date because he felt that its impact would have been spoiled by doing so.

The Future of NATO's R&T

by

Lt. Gen. O.L. Kandborg

General Kandborg is the Director of the International Military Staff at NATO, and the Board was very honoured by his presence at part of their Spring 2000 meeting in Bordeaux. He spoke about his vision for the future of R&T during the meeting, and we are very pleased to be able to include the text here (the emphases are in the original).

Let me tell you from the beginning that I have been looking forward to this Meeting and this evening's Dinner for a long time. I may not have been with you at all the previous meetings, but let me assure you I have been with you in spirit. I wanted to mark this occasion with a few words because *I have had the privilege of being with you from the "moment of creation" so to speak.* As a result, and as a result of our many interactions over the past few years, I wanted to offer my perspective. I will make a very few comments about the highlights, some recent interactions, and what I believe is a very positive future for R&T. Let me start with the highlights.

Almost everyone at NATO will agree with me when I immediately think of the *sometimes difficult consolidation of the AGARD and DRG* into the RTO. Of course, we were trampling on what some would call "sacred ground" when we dared to bring these two organizations together. Fortunately, you had worked closely through the years and then worked very hard to make the new organization a success from the very first. It is a great credit to this group and your predecessors that the research continued, and even improved, during this transition. I am pleased to say that you achieved the desired goal: making a streamlined organization that was even more meaningful to NATO than ever before.

In this vein, I think almost simultaneously of the newly approved *NATO-wide defense R&T Strategy*. I realize this was a first and also a very challenging undertaking. However, the three main themes you have chosen: getting closer to your customers, getting closer to industry, and maintaining your high standards of technical competence, are solidly on the right track. As challenging as the writing of this Strategy was, I am sure the implementation will be even more so. I look forward to helping wherever I can and I am sure my successor will feel the same.

For a final highlight, let me cite the group of watershed studies you have recently undertaken. It may be a routine periodic event for researchers to take stock of the state-of-the-art and project forwards to envision the future capabilities, but let me tell you this is not a standard topic within the Military Committee. We are much more bound by the urgencies of day-to-day activities, and therefore we appreciate your package of studies on aerospace, land, and the nearly completed maritime military operations of the future. I believe these will be guideposts for our interactions for quite a while and came at just the right time in NATO's history. Well done!

I could cite literally hundreds of smaller, yet equally important technical issues, but allow me to group them within the insight of these three major studies.

I will now move to items of very current interest within the military community. How far can I go in this topic without using the terms 'Kosovo', 'DCI' (Defence Capabilities Initiative), 'CDE' (Concept Development and Experimentation), and 'Long Term Requirements'? I see by your recent integration documents that *there are literally hundreds of intersection points between these major issues and the technical work sponsored by this Organization.* Let me again highlight just a few. Your offer to provide a synthesis of the many lessons coming out of the Kosovo crisis is performing a real service to the military community. I understand that the recent workshop was well attended and resulted in wide agreement of the major successes and challenges facing NATO, especially in this relatively new area of non-Article Five operations. The integration of the R&T activities with this and the DCI will go a long way toward giving the Military Committee and CNAD (Conference of National Armaments Directors) technological options to consider and give the R&T community better visibility. Again, my mind also goes to the outstanding work you are doing in many other critical areas such as UAVs (Uninhabited Armoured Vehicles), Electronic Warfare, Non Lethal Weapons, Human Machine Interfaces, Information Technology, Sensors and Electronics, and on and on. I could never name them all, let me just say: keep up the good work!

Let me move now to the final point, the *future of R&T.* You have already heard me mention the vast technical future that your own studies and the current trends indicate. I wish to move to a slightly different aspect. From my perspective within NATO's military community, I see *great opportunity* in several new respects. NATO faces many threats and continuing budget and political limitations at the same time that the potential struggles seem limitless. You may not realize it fully, but you are in a great position of opportunity. *You have a green light to enter the DCI and CDE arenas. SHAPE and HQ SACLANT have invited you to help them define Long Term Requirements* and identify potential sources of technical solutions. AND you have been "awarded" the oversight of the *NATO Modelling and Simulation coordination activities*. It seems to me you have more than enough rope to 'hang' yourselves, or put more positively, all the flexibility anyone could ask to *make a quantum leap in your level of support to NATO*. Think of the influence you will have as you build upon the insights from synthesizing Kosovo lessons, coordinate dozens of high leverage technologies, show how they work together to address critical DCI needs, and propose the very modelling and simulation processes that will allow all this to be easily visualized! Think of the excitement among operational military people as they see clearly the value of many technological developments that they could not even pronounce before! Think of the value to the Ministers and other senior decision-makers as they see solution options to issues they can not even describe very well. And think of the very down-to-earth practical applications as we train, educate, and rehearse our people to handle the most difficult peace support operations we can imagine.

It will, however, also take responsibility. It is not everything new that is good and should be put to use. Not everything that is possible is necessary. Here we need to work together. While the number of projects seems limitless, our resources are scarce. While not curtailing your minds and imagination, I ask for your support to find the realistic and cost-effective innovations and solutions.

In short, four words describe what I've been talking about:

- Leverage,
- Leadership,
- Limitlessness
- Responsibility.

You are in a privileged position of high influence within NATO. Not only are you protected from the daily urgencies, but you have *Leverage*: the necessary connections to work with your customers, industry, and academia to help NATO solve its toughest issues. But this will take *Leadership*: leadership that defines a clear vision and makes the commitment to achieve it. You have that opportunity before you. You also have the environment and brains to get as close to *Limitlessness* as anyone in our vast organization. Use it with *Responsibility* to your best advantage. With a light circumscription of a well-known daily prayer, we could say:

- Lord, Give us the strength to carry through the necessary projects, disregarding how difficult they are;
- Give us the patience to discard those projects that are not necessary, disregarding how tempting they are;
- Give us the wisdom to distinguish between the two.

You will not often get messages like this from military authorities because we are busy with urgent day-to-day matters, but NATO needs a strong R&T community. Please do your very best. I bid you au revoir and best wishes in this exciting future. Thank you.

Farewell and Thanks to Dr Yarymovych and Dr van Hoek

During the address by General Kandborg, Director of the International Military Staff, at the Spring Board Meeting, he referred to the forthcoming departures of Dr Michael Yarymovych, Director of AGARD from 1970 to 1973, Chairman of AGARD from 1994 to 1997 and Chairman of the Research and Technology Board from 1997 to 2000, and of Dr Ernst van Hoek, first Director of RTA, from 1997 to 2000, in the following terms.

Let me close with some words to your outgoing Director and Chairman. I have been with these two fine gentlemen for quite some years and am pleased to count them among my friends. They have done a truly outstanding job for you and for NATO and we will miss them. I have the honour of presenting, along with my colleague, the ASG for Defense Support, Mr Bell, a token from the Secretary General of NATO for Dr. Yarymovych in the form of a letter. Mike is probably too polite to read it for you so I asked the secretary to burn me a copy. It reads:

Dear Dr Yarymovych,

Given your unique contribution to NATO research and your special role as the first Chairman of the Research and Technology Board, I wanted to express to you my personal thanks as you leave our organisation.

I am well aware of the long list of accomplishments you leave behind, but I must thank you in particular for your outstanding leadership during the formative stage of the RTO. I understand that this was no easy task given the differing operating principles of its constituent parts, AGARD and the DRG. You provided the clear vision of purpose, persistence and the power of persuasion needed to merge this diverse group of strong willed international experts into a true team – one which will continue the technical legacy well into the next millenium.

My thanks once again for your fine contribution to the Alliance, and I wish you the very best for the future.

George Robertson

The Secretary General, Lord Robertson

I add my thanks and appreciation for your professional leadership and friendship.

Our Director, Ernst van Hoek, is not leaving until the end of June. Therefore this is not farewell. However, Ernst, I take this opportunity to thank you for your hard work for the RTO and me. You gave me a very valuable introduction to your Agency and its elements and projects. This helped me tremendously to understand the complex and widespread R&T community, and you solved a problem for Norman Ray and myself when we needed a study director to get the review of the standardization organization in train. Thanks so much.

As noted above, Dr Yarymovych was Director of AGARD, from 1970 to 1973, and the editor would like to offer a tribute to Mrs Lana Yarymovych by quoting what Mr Olav Blichner, his successor as Director of AGARD said in AGARD Highlights 74/1:

“When a Director leaves . . .

. . . so does his wife with him. Paris is sweet, but alas! Many are those who will remember you, Lana, for your warm smile, your good humour and, above all, for your boundless hospitality in your home, where so often many of the AGARD family were brought together after a long day’s work for a few relaxing hours.

You practised true AGARDianism, complying with the AGARD Charter by bringing together people from many countries, making them know and, perhaps, understand one another and, above all, making them feel good!

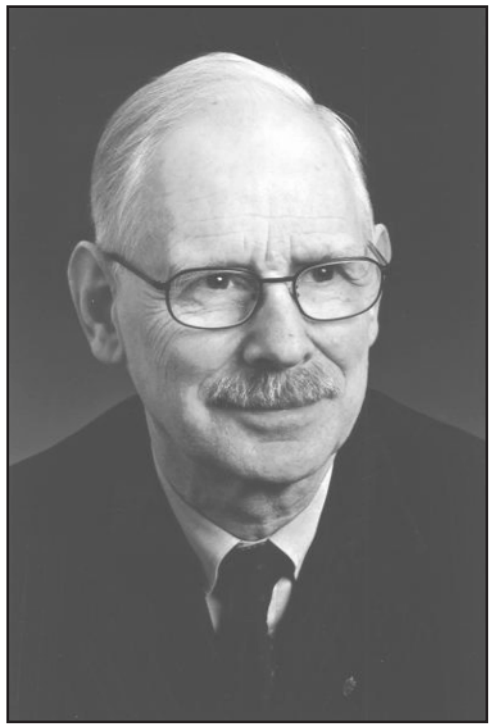
We know, the few of us who could manage some time off to bid you goodbye at Orly Airport on that day in July, that we truly spoke for hundreds when we said..

THANK YOU, LANA, BON VOYAGE AND AU REVOIR”

Mr Blichner is at the left, and Lana and Mike with their children are at the right in this photo taken at Orly Airport when they left Paris in July 1973. More recent photographs of Mike and Lana appear on pages 35 and 43.

The New Chairman . . .

At the Fall 1999 Research and Technology Board Meeting, the Members elected as the next Chairman of the Board, ***Mr Nils Holme****, a Board Member from Norway, where he was Director General of the Defence Research Establishment, who had led the Aerospace 2020 Study of AGARD. He took office as Chairman for three years from the end of the Spring 2000 meeting.*



Nils Holme was born in 1936. He grew up in Trondheim, Norway, where he received his degree as a graduate engineer (applied physics) from the Norwegian University of Technology in 1961.

After university, Mr Holme joined the Systems Analysis Division of the Norwegian Defence Research Establishment (FFI) at Kjeller, where he assessed the performance of maritime aircraft, and tactics for their operations in surveillance of the Northern Waters. He joined SHAPE Technical Center in The Hague as a scientist in 1964, working on computer applications for NATO Air Defence Ground Environment (NADGE). Returning to FFI in 1967, he became project manager for the development of a new weapons control system for the KOBBEN class submarines. In 1971 he became the Assistant Director of Informasjonskontroll A/S, directing for the NATO Industrial Advisory Group (NIAG) a study of alternative concepts for microwave landing systems (MLS). In 1973 he joined Norconsult in Saudi Arabia, as a field engineer on a project to install a telecommunication cable system joining the major cities in the country. Returning to FFI in 1976 he became manager for development of the weapons control system for the German-Norwegian Submarine Project. In 1977 he became Director of Research, and from 1981 Chief of the Electronics Division. A major effort in this period was the development of a new concept for a digital, tactical radio system. In 1988 Mr. Holme joined the Ministry of Foreign Affairs as a special advisor on strategic export control. In 1990 he became the Chief-of-Staff of FFI, and in 1993 he was appointed Director General of FFI.

Mr Holme has served for many years on various NATO groups, including the Tri-Service Group on Telecommunications and Electronic Engineering (TSGTEE), the AGARD National Delegates Board, and the Research & Technology Board from 1997. He was Study Director for AGARD's long term study, Aerospace 2020. He is a member of the Norwegian National Defence Council and the National Defence Research Policy Board. Mr Holme was elected a Member of The Norwegian Academy of Technical Sciences in 1993, and was Chairman of The Polytechnical Society (1997-99). He is Commandeur de l'Ordre National du Mérite of France, and was awarded the von Kármán Medal in 1998.

Mr Holme is a frequent speaker and has published a number of articles on defence related issues and on aspects of government in a historical perspective. He and his Finnish born wife Pirkko-Leena live in Lilleström near Oslo. They have two grown-up daughters.

. . . and Director

At the same meeting, the Board selected as the next Director of the Agency, ***Mr Ken Peebles****, a Board Member from Canada, who had led the R&T Strategy Study, described elsewhere in this issue. He took over his new post on 1 July 2000, also for three years.*

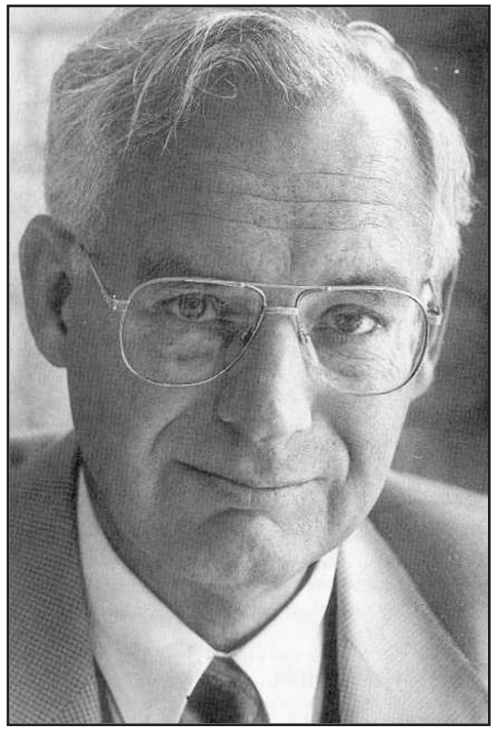
Ken Peebles was born on June 27th, 1940, in Winnipeg, Canada. He received degrees in Electrical Engineering from the Universities of Manitoba and Pennsylvania. He had worked in both the academic and industrial environments before he joined the Canadian Department of National Defence in 1971 as a Defence Scientist. In this role he both conducted and managed research in electromagnetics, then moved to more senior roles in the R&D Branch, becoming Chief R&D in1992.

Mr Peebles' international experience is considerable. He was a Canadian member of both DRG and AGARD, at all three levels of each organization. He was, for example, Chairman of the AGARD GCP, Canadian National Leader of DRG Panel 4, on Electro-Optics, Canadian Member of the DRG, and an AGARD National Delegate. He was a Canadian member of the RTB until assuming his present post.

Much more germane to who he is than his career is his personal life. He is married to Louise Savage, and together they have two children – Brian, age 12, and Emily, age 6. They love exploring, camping, canoeing and sports. Mr Peebles' two great passions are music and books. Schubert, R. Strauss, Haydn and Bach are high on his list in music while George Eliot, Gibbon, Wallace Stegner, and Marquez have written his favourite books. Living in France for three years is a dream come true for the entire family.

The von Kármán Medal for 2000

The von Kármán Medal is awarded in memory of Dr Theodore von Kármán, the founder of both the constituent bodies of the RTO, for "exemplary service and significant contribution to the enhancement of progress in research and technological cooperation among the NATO nations carried out in conjunction with RTO activities". The von Kármán Medal for 2000 was awarded to ***Dr Aart van Meeteren*** *of The Netherlands.*



Dr van Meeteren graduated at Delft Technical University in 1963 with specialisation in optics. His military service, 1963-1965, included work in testing and evaluating night vision and laser distance measuring devices. He started his scientific career at the TNO Institute for Perception, specialising in the physical aspects of human vision. His PhD in 1973 was on "Visual aspects of image intensification". Cooperation with psychologists in TNO intensified his interest in the cognitive aspects of visual perception, and he recognised that human visual perception of signals embedded in pictorial noise comes very close to ideal mathematical decision making.

From 1975 he became more and more involved in the management aspects of R&D in TNO. At first it was still possible to combine substantial research activities with management. However, management rapidly required his full time, in line with the spirit of the time and its typical over-evaluation of accountancy as a surrogate for what used to be confidence. In retrospect he regrets this aspect of his career, but he says, "Into each life some rain must fall, and very little has fallen in mine".

Dr van Meeteren has always been highly interested in international cooperation. NATO was the natural environment, both with Panel 8 of the DRG and with AGARD's AMP. He considered it a great honour to serve as a chairman of Panel 8, and an exciting challenge to help create the present HFM as a fusion of these bodies.

He has recently retired from management responsibilities and is happy to spend more time in other activities, such as those involving his family and his church. More particularly he enjoys reading and thinking about the relations between faith and science. Fortunately, it appears that there is better perspective for peace and harmony between the two.

FORMAL CITATION

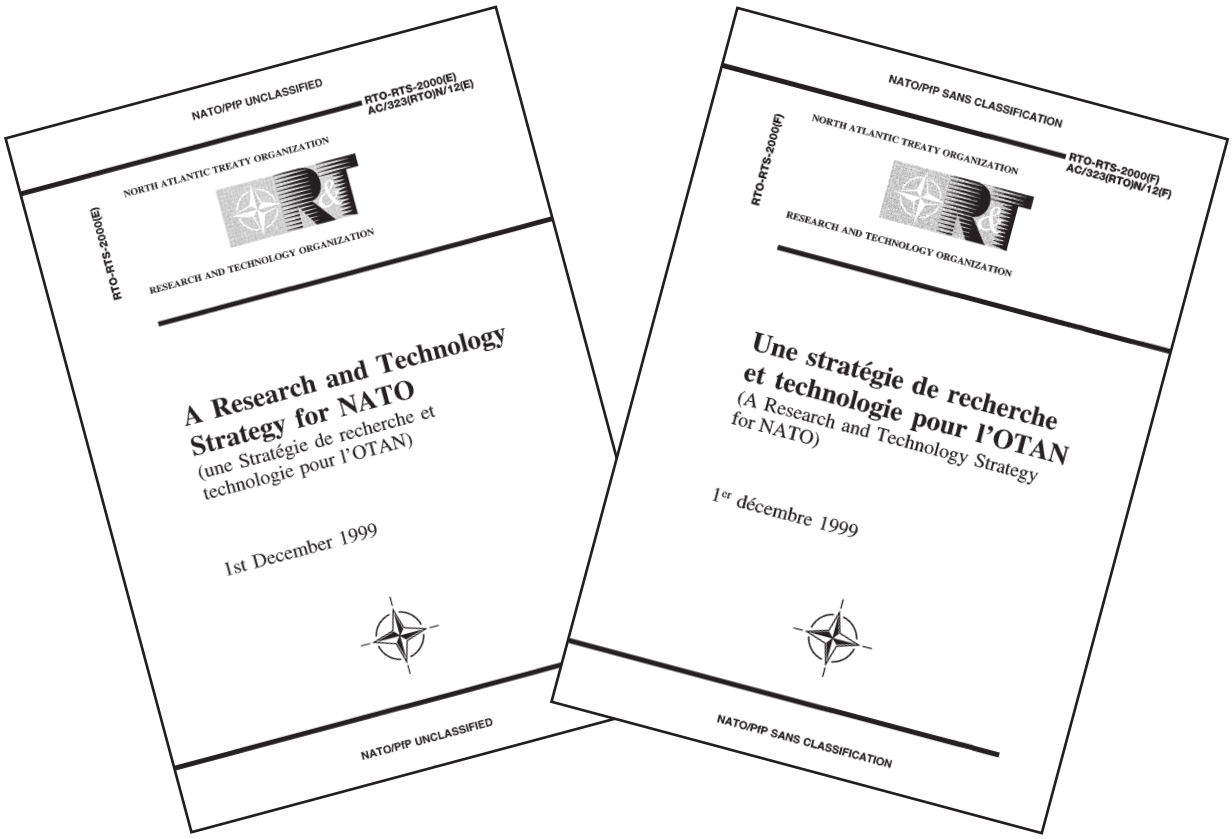
Dr Aart van Meeteren served from 1982-1999 as Director of TNO Human Factors in Soesterberg (NE). In this period, he firmly shaped the Institute into an effective and internationally renowned human factors defence research establishment. He had immediately recognised the importance of international defence research collaboration, and under his inspiring leadership, staff members and researchers of the Institute have been represented in a wide range of DRG, AGARD and RTO activities, as well as in the RTA Staff.

Dr van Meeteren served from 1986-1998 in DRG Panel 8 on "Defence Applications of Human and Biomedical Sciences". In that long period, he showed a strong presence, and later leadership; promoting the importance of high quality research in the area of the human operator in a technologically rapidly evolving military environment. In the delicate process of merging DRG Panel 8 and the AGARD AMP, he served as Chairman of the Transition Team, and of the Human Factors and Medicine (HFM) Panel during its formative Meeting. By carefully balancing the interests of aerospace medicine and human factors research, he played a pivotal role in defining the Mission and Scope, as well as the mode of operation of the HFM Panel.

For well over a decade, Dr van Meeteren's thoughtful, strong and visionary leadership has been decisive in creating the conditions for successful international defence research collaboration in the human factors area.

The von Kármán Medal is awarded by the RTO to Dr van Meeteren in recognition of his significant contribution to, and outstanding leadership in, the enhancement of progress in defence research collaboration among the NATO nations in the framework of the RTO.

NATO's R&T Strategy



Introduction

by Nils Holme, Chairman of the Research and Technology Board

The establishment of a single focal point for research and technology (R&T) in NATO was one of the driving ambitions behind the founding of the RTO. Consistent with this ambition, RTO has been tasked to develop and maintain an R&T Strategy for NATO. This is a demanding task, which must be approached from an understanding of how new technologies and applications can enhance NATO's ability to meet present and future challenges. Also, the Strategy should give priority to efforts which carry promise of high return on investment - whether in terms of NATO budgets or national expert contributions.

The first issue of the NATO R&T Strategy was prepared by a select group of RTB Members, chaired by Mr Ken Peebles. It is reassuring that Ken, now the Director of RTA, will apply his knowledge and judgement to the most important task of implementing the Strategy and guiding its further development. But this clearly is not a task for RTA alone: success will require support from other NATO bodies and the Nations. I have reason to believe that such support will be given, but leadership is expected from RTO and that will surely require efforts from all quarters of our organization.

The Strategy

by Ken Peebles, Director of RTA

How we in the RTO community can best ensure that we are meeting our responsibilities to the military planners and operators, both nationally and in NATO, is the subject of the recently adopted R&T Strategy. I had the very good fortune to be the leader of the team that wrote this strategy. We did not do this in a vacuum, for we went to most of the nations to talk with planners, with national research and development authorities and with military operators. We also spent time in Brussels and Norfolk in order to learn NATO views and needs. The resulting strategy document was thoroughly examined by the Nations and went through several iterations before being approved by the RTB, CNAD, Military Committee, and finally the NATO Council, in December 1999.

There now exists an R&T Strategy (1). It speaks of what we should be, the role we play and the contributions we make; it speaks of who benefits from our work and the kinds of relationships that exist because of the real or potential benefits; it talks about the ways in which R&T is carried out and communicated; and it recommends a way ahead which will ensure that we in the R&T community are able to be of the very highest value to those who need our advice and knowledge.

The clients of R&T

The emphasis on what the strategy calls our clients is deliberate. The urgency of some technological issues and the tremendous interest which is evoked by others makes us forget sometimes why we are doing the work - it has enough inherent interest that we enter the world of technology with little thought of its ultimate use. Our client relations are fundamentally important and we need to recognise that there are several client communities, each needing the inputs only we can provide and each feeling that their needs have first priority. The Strategy makes a clear call for all of us who are involved in NATO R&T to ensure that we know who our clients are, that we ensure that we are diligent in considering how we might best address their concerns and that we are able to communicate with them.

To take one example of a client community, consider the NATO Military client, which the strategy indicates has not been so directly served in the past as it might have been. There is a call in the strategy for more attention to be paid to this client. This does not mean that we must drop what we have done in the past and address only those issues which are defined by the NATO military client. What the strategy tries to make clear is that although much of what has been done does indeed address this client's needs, and the problem has been more one of a mutual lack of communication, in the future these needs should form a part of the programme planning undertaken by the R&T community.

Better Communication

Communication is basic. We must talk with the military planners and operators, both within the nations and within NATO, to understand their needs, to ensure that they know and understand the uses and the implications of the technological progress we have fostered, and to warn them at times of the implications of new developments in the domains of our expertise. If we are not addressing a particular concern, they should understand why. Similar dialogue should occur with armaments planners, those on the materiel acquisition side of defence capability. While the dialogue called for here usually occurs as a matter of course in each of our nations, in the NATO forum we have not been so diligent. Another aspect of communication that is called for is the need for a greater presence of people from industry and from the universities in our Panels and Technical Teams. Their voices, which would add to our discussion the practical knowledge and experience of industry, as well as the forward looking orientation of the academics, need to be heard more strongly within the RTO.

New Concepts

The strategy also calls for the exploration of ways in which the RTO might use new concepts and approaches to carry out its work. Virtual Laboratories are being instituted in some member countries. Their potential in a multilateral environment seems at first glance to be a natural extension of co-operative studies, yet there are many potential hurdles to consider before such an undertaking could be made. Another innovation for the RTO would be for it to undertake co-operative demonstrations of technology. This too has implications which we do not fully understand and which need study. Yet another question that arises is that concerned with whether we are addressing the right subjects. Within our domains of expertise new concepts and capabilities arise as a matter of course, and dealing with them is a part of our responsibilities. Our structure and expertise is not all-embracing, however; we need some way to ensure that topics and disciplines which we are not now addressing but which are beginning to assume a prominence or potential application in defence technology, can be addressed. Simply put, the technology orientation of today cannot be assumed to be something which will remain forever fixed, we must be able to be flexible in our technology portfolio.

Implementation

The discussion above has outlined some of the issues addressed in the strategy. The strategy has, as mentioned, been approved and is now an official NATO strategy. It is not something which can rest on a shelf, it must be implemented. It is the responsibility of everyone to implement the strategy, for it underlies everything we do when we are involved with R&T in NATO. It is self evident that the strategy documents themselves must be read. From there they must be kept in mind in all of our day to day activities and interactions. This is fine when one is dealing with such strategic issues as communication, relevance, client orientation, innovation and harmonisation of work. Implementation of the strategy is not quite so simple when it comes to other strategic issues such as virtual laboratories and co-operative demonstrations of technology. For these two thrusts the issues surrounding their implementation are complex; it is not just a question of a quick implementation decision.

For this reason we have set up Strategy Implementation teams to study the thrusts and to recommend a way ahead for us. The teams are composed of Panel members, volunteered by each Panel. The teams had their first

meeting at the Ecole Militaire in Paris in June 2000, and have been working since then to provide us with an initial look at what we might do and what some of the problems might be. The teams were formed to examine the following topics:

The way to focus on Client Relationships and the establishment of a NATO-wide Focus for R&T

There are several clients for NATO R&T: the individual nations of the Alliance, the Major NATO Commands, and the International Military Staff (IMS) and International Staff (IS) in NATO headquarters. A concerted effort must be made so that the needs of all these clients are considered when defining the R&T program. Equally important, the work of R&T must be clearly communicated to all clients, and clients must view R&T as responsive and valuable.

The NATO R&T bodies must also work together to best meet NATO and national needs. Regular interaction, cooperation and dialogue are required to assign the appropriate resources and expertise to immediate technical issues.

The Team Coordinator is Mr C.D. WRIGHT (UK) working for SACLANT, and an RTO SAS Panel Member.

The Initialization of a Strategic Review and Analysis of new Technologies emerging from Laboratories

NATO R&T bodies must be able to consider the defence applications of emerging technologies that may not conveniently fit into the present structure. These technologies may arise in civil industries or university laboratories. Consideration of their usefulness and impact on defence must be everyone's constant responsibility.

The Team Coordinator is Mr F. CHRISTOPHE (France) working for ONERA, and an RTO SET Panel Member.

The Establishment of Virtual Laboratories

The concept of virtual laboratories, where teams with expertise in a designated technology work together in a laboratory "without walls", is being developed in several nations. The concept could potentially create greater interaction between experts at a lower cost in a shorter time period.

The Team Coordinator is Mr R.F.W.M. WILLEMS (The Netherlands) working for TNO-FEL, and an RTO SAS Panel Member.

Approaches to Cooperative Demonstrations of Technology

NATO R&T should begin studying the benefits of moving R&T cooperation in NATO significantly beyond information exchange and into the domain of demonstrations of technology. Such demonstrations, carried out cooperatively, would:

- Give nations a confidence in a technology's capability;
- Make the client aware of its possibilities;
- Involve industry more directly; and
- Smooth the transition to operating systems when an acquisition decision is appropriate.

The Team Coordinator is Dr David ANDERSON (UK) working for DERA, and an RTO AVT Panel Member.

The final reports of these four Specialists' Teams are expected in 2001.

As mentioned above, while the work of these teams is important for the growth and progress of the RTO, we all share the responsibility of working toward the ends called forth in the Strategy. The technical needs of Nations and of NATO are our focus, but behind these must always lie the concepts and goals which are articulated in the Strategy. In this way we will all contribute to the maintenance of R&T as a cornerstone of the capability of the Alliance.

1. Published in three volumes, December 1999:
   RTS-2000(E): The Strategy and recommendations for implementation.
   RTS-2000(F): La stratégie et les actions pour la concrétiser.
   RTS-2000(S): Background information for understanding NATO R&T, and other relevant material.

From Automation to Autonomy: Trends towards Unmanned Autonomous Systems

by

Professor Dr Ing. Uwe Krogmann

Professor Krogmann presented this topic as the subject of a Keynote Address to the SCI Symposium on Advances in Vehicle Systems Concepts and Integration, held in Ankara, Turkey in April 1999 (see publication MP-44). As it was well received there and he received many enquiries about it afterwards, he felt that it would be appropriate to publish it in Highlights to give it a wider distribution. We are delighted to do so, since unsolicited offerings for Highlights are all too rare.

Summary

The development, procurement and utilization of advanced systems will in future be strongly influenced by affordability. A considerable potential for cost reduction is seen in the extended use of automation reaching as far as autonomous unmanned systems. An air vehicle is taken here as an example. Starting with conventional and intelligent automation issues, this paper will describe important enabling techniques and technologies as a prerequisite for the implementation of future autonomous systems with goal- and behavior-oriented features. Main emphasis is being placed on information technology with its computational and machine intelligence (CMI) techniques. The treatment of conceptional system approaches will be followed by design considerations and then a global methodology for the engineering of future autonomous systems will be dealt with.

Critical experiments for technology evaluation and validation will be mentioned together with a brief description of the main focus in future research.

1 Introduction

Tactical systems are implemented as Integrated Mission Systems (IMS) such as e.g. air and space defense systems. Key elements of IMS are - among others - platforms with sensors and effectors, ground based components with communication, command and control etc.

In technology, evolutionary progress is generally determined by the interaction between the “Requirements Pull (RP)” and the “Technology Push (TP)” (Fig. 1).

Ever increasing requirements for more and more complex systems and their functions activate individual key technologies within the technological basis available or possibly to be created. However, new technologies - such as currently the new Information Technology (IT) - exert pressure towards increased requirements for new systems.

In the future progress primarily will be driven by economic aspects rather than by technological advances alone. Within this context “affordability” is of decisive importance. Advancing Technologies are essential for

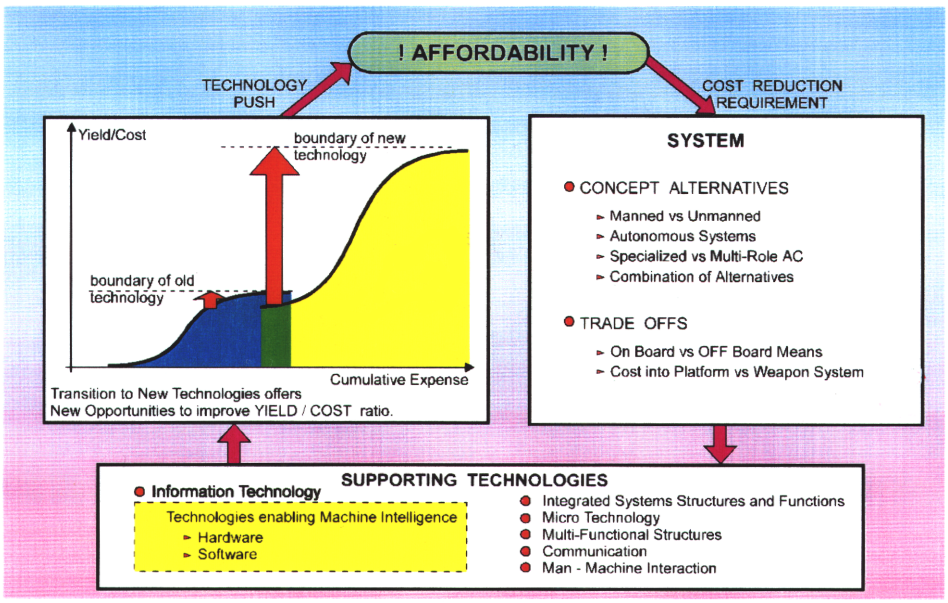


Figure 1: Requirements pull vs. technology push

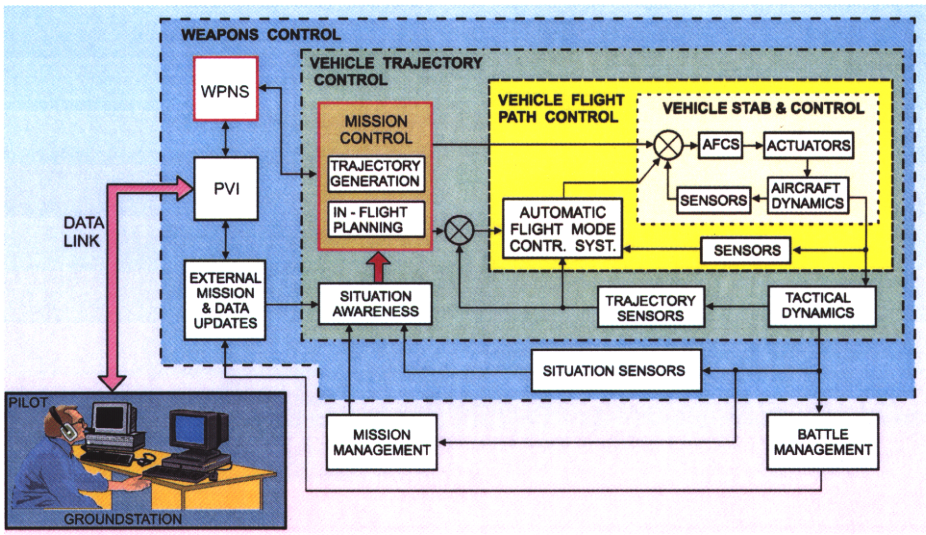


Figure 2: Cascaded air vehicle control loops

achieving unprecedented capabilities for new systems at affordable cost. Looking at Fig. 1 (upper left) the yield/cost ratio is plotted against the cumulative expenses for old and new technologies (e.g. Information Technology). Considering the general performance potential, the transition to new technologies is mandatory to offer new opportunities and improved yield/cost ratios. Autonomous unmanned systems surely are a viable step to cope with the cost reduction challenge and to improve cost effectiveness in the future.

The key notions “automation” and “autonomy” are intimately connected with advances in Information Technology. Therefore emphasis is placed on this aspect.

2 Intelligent Automation

Taking air vehicle as an example, the Unmanned Air Vehicle (UAV) is a concept to integrate advanced technologies into a complete air operation system in order to enable a general purpose high performance aircraft to perform a full range of missions without the physical presence of a pilot in the aircraft.

Figure 2 depicts the multi-dimensional closed loop guidance and control blockdiagram of an UAV with the remote pilot or - more general - the operator being integrated through a bidirectional data link. Progressing from inside out the inner stabilization and control loop of the vehicle represents the lowest level of the hierarchical control structure. The next higher level performs flight path control followed by the mission and vehicle trajectory control as well as the payload control functions being the highest level of the functional blockdiagram.

Automation of most, if not all, of the said functions applying more or less conventional techniques such as algorithmic, numerical and expert system approaches coded in software for sequential processing, represents the state of the art concerning manned aircraft in use today.

As far as UAVs are concerned the obtainable level and performance of automation utilizing conventional techniques is not sufficient. Among others it would require too much of external operator’s control intervention and hence pose very hard requirements for the data link.

To alleviate this problem, the objective and challenge is to replicate the operator’s brain in the vehicle by artificial brain like information processing structures (virtual pilot). For this purpose computational and machine intelligence (CMI) techniques as summarized in Figure 3 and dealt with in a little more detail under paragraph 3 and in [1] can be applied.

Often today they are aggregated under the notion of soft computing.

With that, technologies, techniques and methods are available, by means of which the cognitive abilities of humans for detection, classification, identification, assessment of a situation and of objects in it as well as for goal oriented behavior can attempt to be automated.

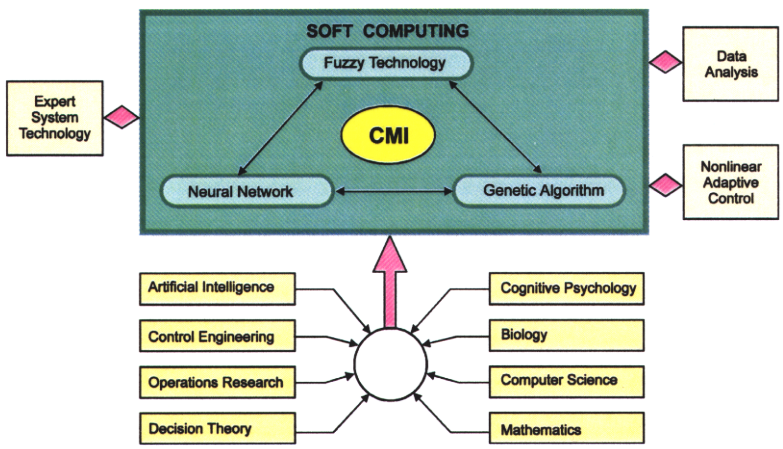


Figure 3: Soft-Computing/CMI and contributions from other areas

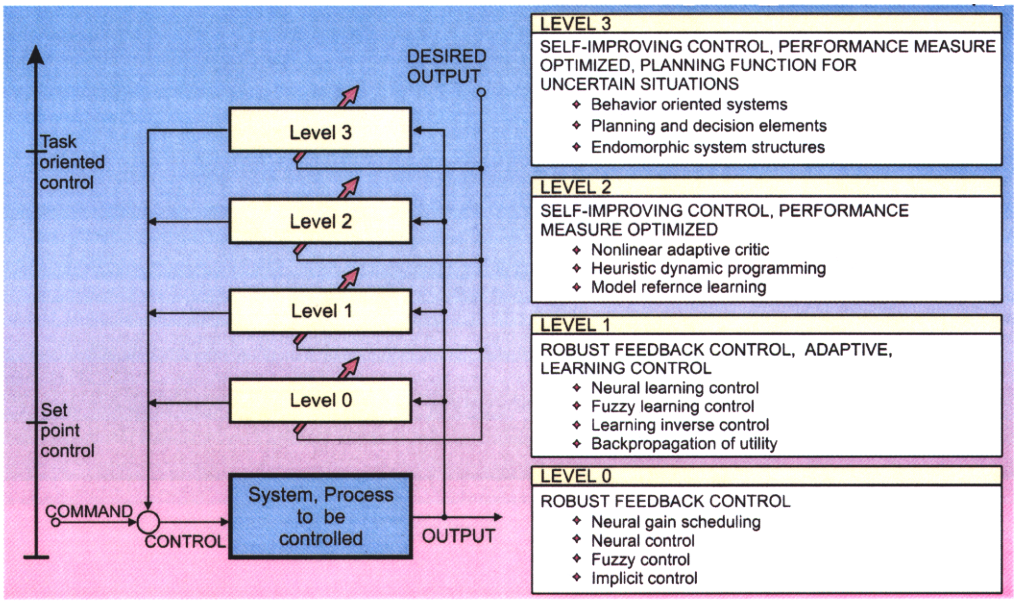


Figure 4: Levels of intelligent, knowledge-based control

This is accomplished by designing and implementing corresponding artificially intelligent control elements, which roughly can be classified into the different levels as indicated in Fig. 4.

These levels can be assigned to the functional levels of Fig. 2 accordingly. For further details it must be referred to the corresponding literature such as [3].

Ever increasing complexity of systems is gradually leading to the limits of conventional and even intelligent control. In this context a complex dynamic system is characterized by the terms dimensionality, uncertainty and vagueness, interconnection of many subsystems as well as data and information explosion. To a large extent this applies to future unmanned systems.

To cope with the said limits of control and automation of such systems, the transition to self-organizing autonomy must be performed and ways to design, build and operate autonomous systems must be established. The remainder of this paper is dealing with aspects of this challenge.

3 Autonomous systems

Autonomy is the ability to function as an independent system, unit or element over an extended period of time, performing a variety of actions necessary to achieve predesignated objectives while responding to stimuli produced by integrally contained sensors. The following characteristics are therefore typical of an autonomous, behavior-oriented system:

- An “environment” (real world) is allocated to the system
- There is an interaction between the system and the environment via input and output information and possibly output actions
- The interactions of the system are concentrated on performing tasks within the environment according to a goal-directed behavior, with the system adapting to changes in the environment.

The interaction of the systems with the surrounding world can be decomposed into the following elements of a recognize-act-cycle (or stimulus-response-cycle):

- Recognize the actual state of the world and compare it with the desired state (which corresponds to the goal of the interaction). (MONITORING)
- Analyse the deviations of actual and desired state. (DIAGNOSIS)
- Think about actions to modify the state of the world. (PLAN GENERATION)
- Decide the necessary actions to reach the desired state. (PLAN SELECTION)
- Take the necessary actions to change the state of the world. (PLAN EXECUTION)

To perform these functions, first of all, appropriate sensor and effector systems must be provided, as mentioned earlier. In the case of unmanned autonomous systems information processing means must be incorporated that apply machine intelligence to perform the tasks mentioned.

At this point and in this context the following question shall be addressed:

What is computational, machine or, more generally, artificial intelligence? In relation to the issues and topics treated here, the following answer shall be given:

- Systems/units have no artificial intelligence if a program/software “injects” them with what they have to do and how they have to react to certain pre-specified situations.

- Systems/units have artificial intelligence if their "creator" has given them a structure - not only a program - allowing them to organize themselves, to learn and to adapt themselves to changing situations.

Thus intelligent structures must be able to comprehend, learn and reason.

4 Enabling new information technology

Paradigm shift to brainlike structures

The expected unprecedented advances in computing based on the conventional architecture, where processing is performed sequentially, do not yield the power for computational and machine intelligence.

There is a paradigmatic complementary shift from symbolic artificial intelligence techniques to a new paradigm, which is inspired by modelling the conscious and unconscious, cognitive and reflexive function of the biological brain.

Important related computing methodologies and technologies include, inter alia, fuzzy logic, neuro-computing and evolutionary and genetic algorithms as summarized in Fig. 5.

Fuzzy Logic

The theory of fuzzy logic provides a mathematical framework to capture the uncertainties associated with human cognitive processes, such as thinking and reasoning. Also, it provides a mathematical morphology to emulate certain perceptual and linguistic attributes associated with human cognition. Fuzzy logic provides an inference morphology that enables approximate human reasoning capabilities for knowledge-based systems. Fuzzy logic/fuzzy control has developed an exact mathematical theory for representing and processing fuzzy terms, data and facts which are relevant in our conscious thinking.

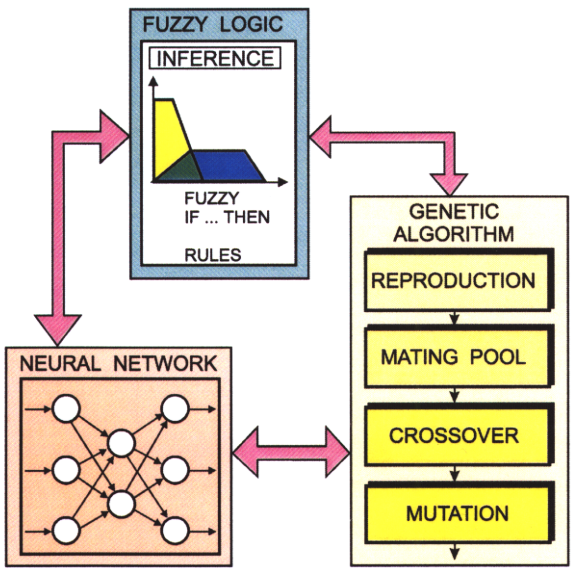


Figure 5: Biologically inspired computing technologies

A unit based on fuzzy logic represents an associator that maps crisp spatial or spatio-temporal multi-variable inputs to corresponding associated crisp outputs. The knowledge which relates inputs and outputs is expressed as fuzzy if-then rules of the form IF A THEN B, where A and B are linguistic labels of fuzzy sets determined by appropriate membership functions.

Fuzzy rule based systems enable endomorphic real world modelling. With this technology human behavior can be emulated in particular as far as reasoning and decision making and control is concerned, taking into account the pervasive imprecision of the real world. Fuzzy logic strongly supports realistic modelling and treatment of reality.

Artificial Neural Networks (ANN)

Neural Networks are derived from the idea of imitating brain cells in silicon and interconnecting them to form networks with self-organization capability and learnability. They are modelled on the structures of the unconscious mind.

Neurocomputing is a fundamentally new kind of information processing. In contrast to programmed computing, in the application of neural networks the solution is learnt by the network by mapping the mathematical functional relations. Neural networks are information processing structures composed of simple processor elements (PE) and networked with each other via unidirectional connections. The "knowledge" is contained in the variable interconnection weights. They are adjusted during a learning or training phase and continue to be adapted during operational use. With this capability the ANN represents an associator (like a fuzzy logic unit) that maps spatial or spatio-temporal multi-variable inputs to corresponding associated outputs. However, in contrast to a fuzzy-rule-based system the mapping function is learnt by the ANN. Neural Networks are capable of acquiring, encoding, representing, storing, processing and recalling knowledge. These are important prerequisites for endomorphic real world modelling.

Genetic and Evolutionary Algorithms

Genetic and evolutionary algorithms represent optimization and machine learning techniques, which initially were inspired by the processes of natural selection and evolutionary genetics.

To apply a genetic algorithm (GA) potential solutions are to be coded as strings on chromosomes. The GA is populated with not just one but a population of solutions, i.e. GA search from a population of points rather than from a single point. By repeated iterations a simulated evolution occurs and the population of solutions improves, until a satisfactory result is obtained. This is accomplished by iteratively applying the genetic operator's reproduction, crossover and mutation.

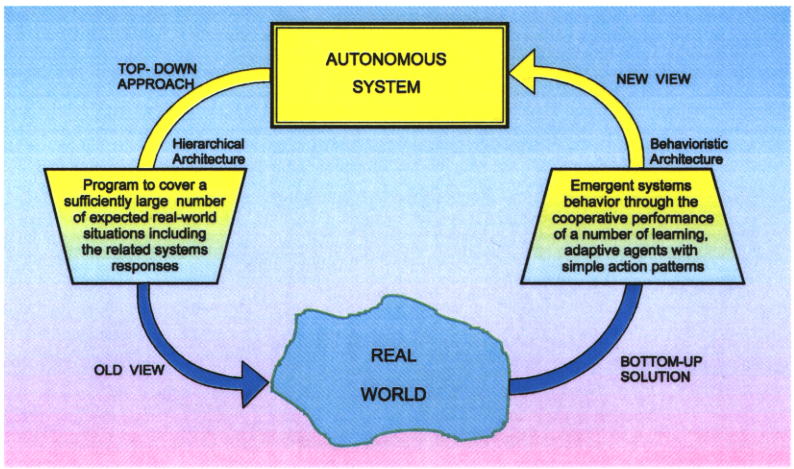


Figure 6: Top-down vs. bottom-up approach

Computer simulation is a viable tool to optimize behavior oriented systems by utilizing genetic or evolutionary techniques. Ever increasing processing speed enables the quick motion representation of events and processes, for which nature requires millions of years.

Conclusions

It was shown that fuzzy and artificial neural network techniques enable the endomorphic modelling of real world objects and scenarios. Together with conventional algorithmic processing, classical expert systems, probabilistic reasoning techniques and evolving chaos-theoretic approaches they enable the implementation of recognize-act cycle functions as mentioned. Genetic and evolutionary algorithms can be applied to generate and optimize appropriate structures and/or parameters to acquire, encode, represent, store, process and recall knowledge. This yields self-learning control structures for dynamic scenarios that evolve, learn from experience and improve automatically in uncertain environments. Ideally, they can be mechanized by a synergetic complementary integration of fuzzy, neuro and genetic techniques. These techniques support the move towards adaptive knowledge based systems which rely heavily on experience rather than on the ability of experts to describe the dynamic, uncertain world perfectly. This is accomplished by consideration of the tolerances for imprecision, uncertainty and partial truth to achieve tractable, robust and low cost solutions for complex problems. Thus, these techniques, in conjunction with appropriate system architectures, provide the basis for creating behavior-oriented autonomous systems.

5 Conceptual Ideas

System Architectures

The viable architecture must represent the organization of the systems intelligence and capability to behave, to learn, to adapt and to reconfigure in reaction to new situations in order to perform in accordance with its functionalities. Based on fundamentally different philosophies regarding the organisation of intelligence, two different architectures can be basically considered (Fig. 6). With the well known top-down approach as prevalently used to date a hierarchically functional architecture results. It structures the system in a series of levels or layers following the concept of increasing precision with decreasing intelligence when going from top to bottom. Implementation is characterized by the fact that for as many contingencies as possible the allocated system

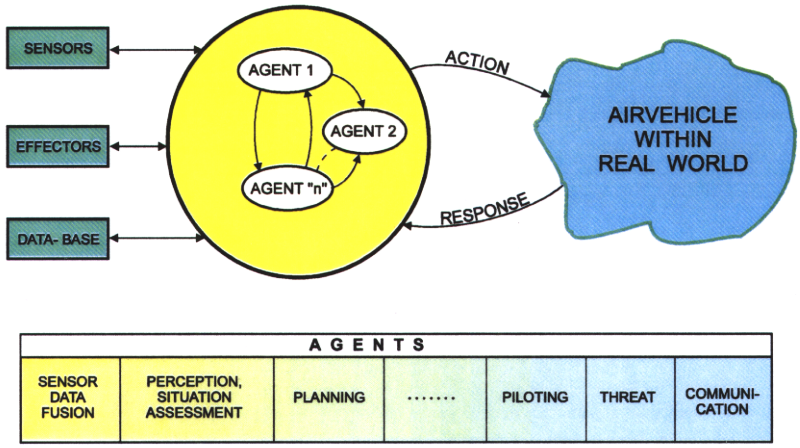


Figure 7: System representation by agents

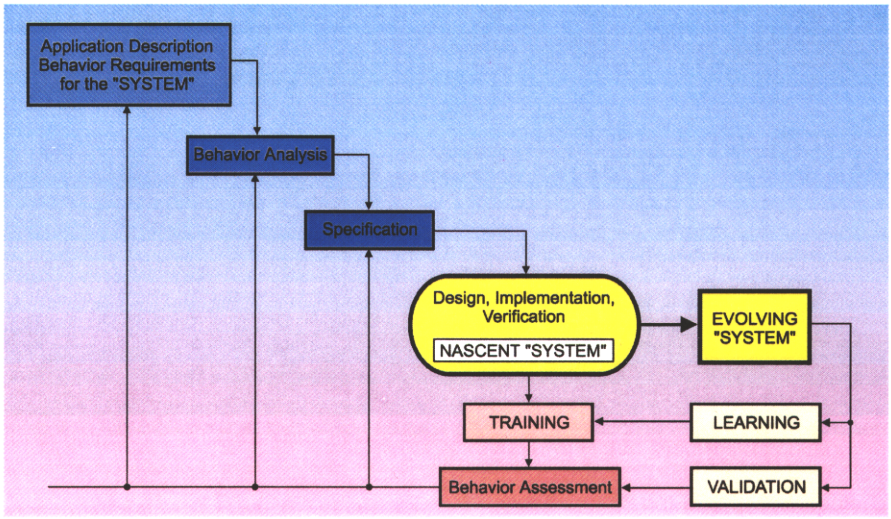


Figure 8: Engineering of the autonomous system

behavior is fixed in top-down programming. In fact, the real world is so complex, imprecise and unpredictable that the direct top-down programming of behavioral functions soon becomes very difficult if not almost impossible.

Considerably different from the hierarchical structure is the subsumption architecture. It is based upon building functionality and complexity from a number of simple, parallel, elemental behaviors. It is sometimes called the behaviorist architecture and is based on a bottom-up approach. In this approach, so-called agents are implemented with the most simple action and behavior patterns possible so that the resulting emergent system behavior corresponds to the desired global objective. The system is able to adapt itself to changing situations in the environment by learning. The specific local intelligence of the individual agents generates a global intelligent behavior of the integrated overall system. Multi-agent systems are complex and hard to specify in their behavior. Therefore there is the need to endow these systems with the ability to adapt and learn. This can be accomplished by the application of the technologies mentioned before.

A simplified block diagram of an autonomous air vehicle based on such a concept of cooperative AI/KB-Agents, is depicted in Fig 7. The objective is to implement as many simple agents as possible with the associated behavior pattern, which then make the system act in a flexible, robust and goal-oriented manner in its environment through their additively complementary interaction. To enable the generation of emergent characteristics it must be ensured that the agents can influence each other mutually. Emergent functionality is one of the major fields of research dedicated to behavior-oriented systems.

Intelligent hardware/software agents will fuse sensor information, monitor critical variables, generate optimized plans, alert operators through communication to problems as they arise and recommend optimized solutions in real time. Response agents capture basic data, communication (forecast and other information) and apply optimization technology to generate new plans based on changed conditions and states.

Regarding intelligent control architectures there is a continuum of design choices concerning the system's functional decomposition. It ranges from a hierarchical structure with metareasoning to completely distributed multi agent systems.

Design Considerations

As in Engineering, it is also an indispensable prerequisite for an autonomous system that it be designed, constructed and trained according to a strict methodical approach. Fig. 8 shows such an approach in a very simplified form from today's technological point of view [4].

It starts with the description of the physical system, its application, the initial environment, and the behavior requirements, with the latter being usually informally stated in natural language. The following behavior analysis is one of the major tasks. This step involves the decomposition of the target behavior into simple behavioral components and their interaction. Part of the specification is the architecture of the intelligent control system. It is the second key point during the engineering process. With the specification all information is available to design, implement and verify a nascent system, which is endowed with all its hardware and software components, however, prior to any training.

Based on a suitable training strategy the system acquires its knowledge during a training phase which is mandatory and prerequisite for appropriate behavior of the system. Training can usually be sped up by applying simulation including virtual reality. Within this context environments can be used that are much more changeable than the real ones.

After completion of training the behavior is assessed with respect to correctness (target behavior), robustness (target behavior vis-à-vis changing environment) and adaptiveness. Based on this assessment, further iterations

during the engineering steps might become necessary in order to make the satisfactorily behaving system evolve from them in a step by step sense.

Implementation Issues

Implementation issues such as:

- hardware for computational and machine intelligence
- software technology, software generation techniques
- autonomous control technology
- autonomous planning and routing
- integrated system structures and functions
- adaptive autonomy management

could not be treated here. Please refer to the Literature, e.g. [5].

6 Emergence of Autonomous Systems

The critical technologies, such as the new paradigm information and control technologies, are indeed highly developed activities, however still mainly in universities and industry research and development branches. Thus a time interval of 8 to 15 years is likely to elapse until applications can be expected within systems as treated here.

Beyond the enabling technologies further technical issues such as:

- maturity assessment
- system concepts, architecture and mechanization
- critical experiments
- validation, certification techniques
- future research focus

shall be emphasized, because they critically influence the emergence of autonomous air vehicles. Stepping back to the first section and recalling the interdependence of the Requirements Pull and the Technology Push it is of paramount importance for research planners to identify applications and requirements indicating the indispensable need for such systems and their capabilities. In this context the Uninhabited Tactical Aircraft (UTA) concept of variable autonomy currently under investigation, offers an ideal platform to perform critical experiments for the evaluation, validation and possibly certification of techniques and technologies.

Autonomous unmanned air vehicles will be designed such that they offer fully autonomous operation. However, provisions will be incorporated allowing a human to monitor the system's operation and to intervene if required.

7 Final remarks

Complexity is a central problem in advanced system theory and engineering. The concept of building a high performance system around a central computer with top-down programming has long become obsolete. Well organized complexity with distributed CMI as briefly treated here is the way of the future.

Significant changes are currently taking place in the new information technology (IT) and other technological areas as far as functional capabilities, performance, characteristics and cost are concerned. These changes will support the new way and influence the users of related technologies and the supporting industries as well as their technical and organisational structures. Organizational structures have always reflected system structures. The rate of change and related realizations will exceed normal evolution and will have great social impacts accompanying the technological and functional advances. Instead of spin-offs, considerable spin-in effects from commercial research and industry will impact military applications. Simultaneously a global availability of commercial High-Tech must be assumed.

In order to accommodate all this, the strategies of users and industry must be adapted accordingly. Looking at the interdependence of requirements, technologies, procurement processes and time behavior, 10 years is a short period.

WE MUST BEGIN NOW!

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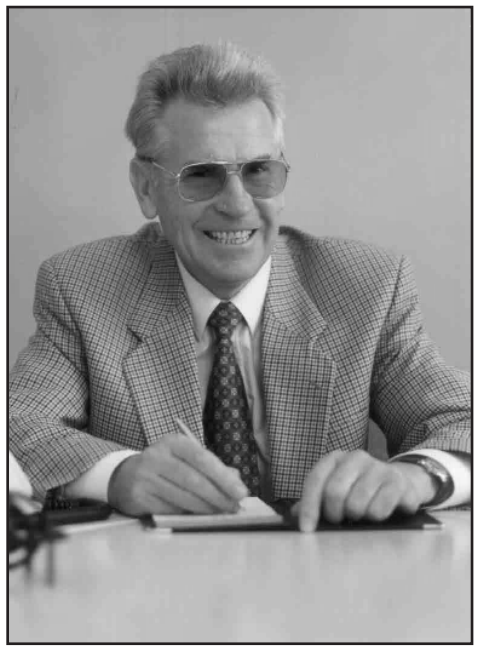
Dr-Ing. UWE K. KROGMANN



Uwe Krogmann studied applied physics at PTL, Lübeck, Germany. He received his "Diplom-Ingenieur" degree in 1960 and the "Doktor-Ingenieur" degree in 1995 from the University of Braunschweig, Germany.

He joined Dynamit-Nobel Corp. (1960) working in the fields of rocket ballistics, aerodynamics and windtunnel testing.

In 1963 Uwe Krogmann began his work with Bodenseewerk Gerätetechnik GmbH (BGT), Überlingen, now a Company of "Diehl VA Systeme". Here his tasks were primarily analysis, design, simulation, testing of inertial and hybrid navigation systems, flight control and guidance systems as well as related digital computers.

Dr Krogmann has performed and directed Research and Development work for numerous projects in this field and was responsible for the development and preproduction for several navigation, guidance and control systems, also in international cooperation.

Currently Uwe Krogmann is head of Systems Technology in BGT's "Research and Development Division" where work is performed on advanced guidance, navigation and control techniques, information and data processing, system concepts, architecture, simulation, modeling and mechanization.

His research and technology interests are primarily in the areas of intelligent control; neuro-, fuzzy-, genetic computation; autonomous systems; knowledge- and behavior engineering.

In 1979 Dr Krogmann received the "Wolfgang Martini Award" from the German Institute of Navigation (DGON) – See also page 51 of this issue of Highlights.

Since 1980, Dr Krogmann has participated in various AGARD Panels and currently he is a member of the System Concepts and Integration Panel (SCI) within the RTO.

RTA - The Research and Technology Agency An Essential Contribution to NATO's Future

This was the title of an article prepared by RTA, using contributions provided by each of the Panels and NMSG, for inclusion in a special issue of the periodical 'NATO's Nations and Partners for Peace' (formerly 'NATO's 16 Nations') devoted to NATO's agencies. It was originally scheduled to appear in October 2000, and we intended to reproduce the cover and the first page of the RTO article here. Unfortunately, publication has been delayed (at NATO's request, we understand) even more than this issue of Highlights, and it had not appeared when Highlights was being prepared for printing. The text of the article and its illustrations follow.

FOREWORD

by Nils Holme
Director General, Norwegian Defence Research Establishment
Chairman of the Research and Technology Board of NATO

It gives me great pleasure to introduce this article on the Research and Technology Agency. As you peruse the article you will get a sense of the wide range of technologies which we deal with and the many mechanisms we employ to ensure that our goals of excellence, timeliness, relevance and flexibility are met. Our involvement in R&T requires not only that NATO should have the best possible technological capability at its disposal but that we ensure that NATO planners and decision makers are fully aware of the implications of technology in their domains. I hope that you will get a good sense of this from what follows.

INTRODUCTION

by Ken Peebles
Director, RTA

The NATO Research and Technology Agency (RTA) supports and co-ordinates the NATO Research and Technology Organization (RTO). The mission of the RTO is to conduct and promote co-operative research and information exchange to support the development and effective use of national defence research and technology to meet the military needs of the Alliance; to maintain a technological lead; and to provide advice to NATO decision makers. This article will outline the role and organization of the RTO and the RTA, highlight some of the many RTO accomplishments, and close with a brief overview of the Organization's strategic plan for the future.

NATO's R&T ensures that the Alliance has at its disposal the best scientific knowledge and technical capability that member nations are prepared to make commonly available. The most efficient way of delivering required technological capabilities to NATO is to embed them in equipment during the early phases of the R&D process. This in turn demands that:

- The nations exchange, mutually understand and where possible, collaborate on research into technologies and weapon system(s);
- These weapon systems are produced by nations' industries at an acceptable cost and are capable of defeating perceived threats;
- The nations have a common technological base that contributes to the stability, balance and well-being of the Alliance; and
- A better capability is created through the synergy of Alliance members working together on technological challenges, problems, and solutions.

The task of NATO's R&T is to ensure that these conditions can be met.

The Organization

The Research and Technology Organization (RTO) was formed in 1998 by the merger of two NATO bodies: AGARD (the Advisory Group for Aerospace Research and Development) and DRG (the Defence Research Group). The aim of the merger was primarily to ensure that NATO's structure was better adapted to the changing defence environment, in particular by providing a common focus for all NATO's Research and Technology activities and developing an R&T strategy for NATO. It has carried out both tasks in the short time that has elapsed since its formation, and has just started to implement the strategy.

The supporting Agency (RTA) has about thirty NATO civil servants and a further twenty, both military and civilian, supplied voluntarily by the nations for limited periods. Its headquarters and most of the staff are in Neuilly-sur-Seine near Paris, but a small unit is located in Brussels, in NATO HQ.

The Research and Technology Board (RTB) is the highest authority within the RTO, and is the policy body tasked by the North Atlantic Council through both the Military Committee (MC) and the Conference of National Armaments Directors (CNAD). Its membership comprises up to three leading personalities in the field of defence research and technology from each NATO nation.

The Agency's Headquarters, near Paris

They may come from government, industry or academia. Ex-officio representatives are also appointed by the NATO R&T agencies, NC3A and SACLANTCEN, and the NATO Strategic Commands. The Chairman is a senior member of the Board, elected by the national members for a three-year term. Each nation appoints a National Coordinator to oversee its RTO activities.

The six Technical Panels and the Modelling and Simulation Group each consist of national experts, including a number of 'Members at Large', who are recognised as world-wide experts from the NATO nations. The Panels are the 'heart' of RTO, since they propose, develop and steer the various tasks that together make up the technical programme of the organization. Examples of their recent work are given below.

Technical Teams are formed by the Panels to carry out the different items in the programme, which may be requested by the Military Committee, CNAD or the nations, and which essentially fall into four categories:

- Task Groups of experts studying particular well-defined topics;
- symposia, specialists' meetings or workshops;
- lecture series or courses;
- AGARDographs (monographs on a single clearly-defined subject).

Technical publications result from each of these activities - some 10,000 pages a year - and the Agency is rapidly moving towards all-electronic dissemination of its unclassified publications. Most will be available on the Web site (www.rta.nato.int). A Consultant and Exchange Programme enables the Panels and the nations to obtain help on specific problems by visits, mostly of one week's duration, from experts in the NATO nations.

RECENT EXAMPLES OF THE PANELS' WORK

Studies, Analysis and Simulation Panel (SAS)

The Mission of the Studies, Analysis and Simulation Panel is to conduct studies and analyses of an operational and technology nature, exchange information on operational analysis (OA) technology and advance the development of OA methods and tools, and provide a forum for modelling and simulation oriented towards operational issues.

Lessons Learned from Kosovo

Shortly after the Kosovo campaign, the Panel decided to conduct a synthesis of others' lessons from Operation Allied Force (OAF). It was a fast-track, limited scope, effort to compare lessons and report on the results. A first workshop in September 1999 compared analysis plans, and a second in February 2000 compared analysis results. The objective was to synthesise the available OAF lesson analyses from NATO nations and organisations and report the results to the military and armaments communities within NATO. Due to the sensitive nature of this activity, all the work was highly classified.

During the first workshop the study team derived a broad set of taxonomy categories, which would cover the OAF lessons. The Military Committee then invited NATO nations and organisations to report their analysis results, using these detailed taxonomy categories, at the second (Synthesis) workshop, to which over 90 participants, representing 11 Nations and 11 NATO organisations contributed. They delivered and received 17 candid

A radar station, located on a mountain close by Pristina, after Alliance's SEAD actions

briefings, exchanged strong professional opinions, and collaborated in synthesising a pithy summary for each of the 28 categories, resulting in 56 lessons. RTO supplied several people to provide an integration between the lessons synthesised and the over 120 research efforts sponsored by NATO.

The results have been briefed to numerous NATO organisations, including the Military Committee, SHAPE and AFSOUTH, who expressed very significant interest in them. They identified both successes and challenges. The successes include:

- maintaining Alliance cohesion under severe testing
- recognising that airpower met the political objectives under difficult circumstances
- highly motivated people overcame numerous limitations (as always) to make the campaign a success

The main challenges involve the policies, procedures, and structures used in non-Article V operations, which includes both forces and equipment. All challenges are being addressed in on-going efforts within NATO and this synthesis effort is one of the many contributions.

Information Systems and Technology Panel (IST)

The mission of the Information Systems and Technology Panel is to advance and exchange information systems techniques and technologies (a) to provide timely, affordable, dependable, secure and relevant information to warfighters, planners and strategists, and (b) for modelling, simulation and training.

Speech Processing

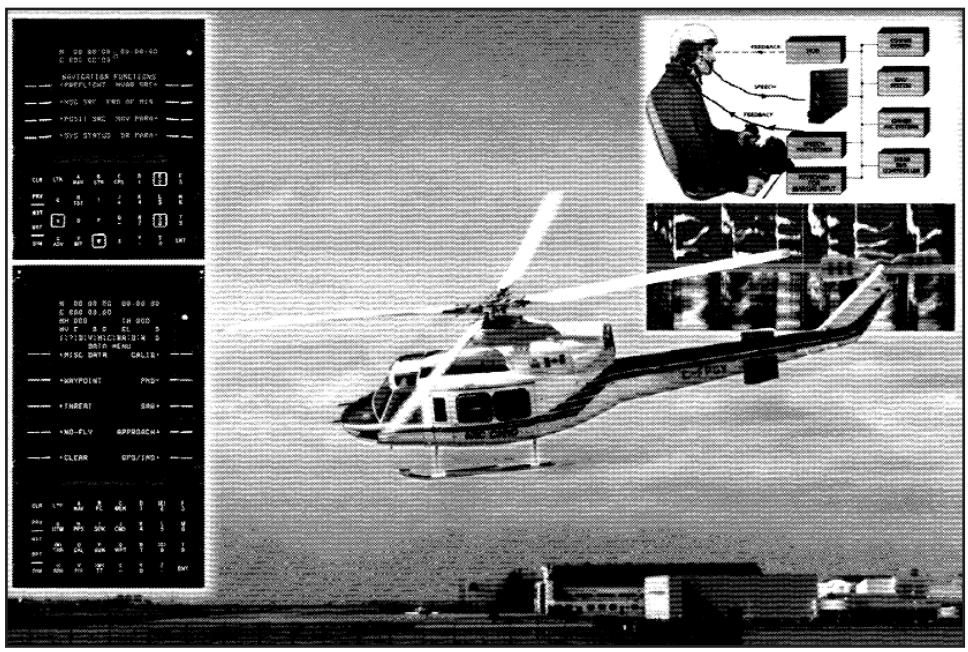
IST is investigating and trying to overcome the hurdles preventing the efficient application of speech technology in military systems. Military operations occur in noisy and immediately stressful environments, and frequently - especially in NATO - between non-native language speakers. Solutions that work well in the office environment often prove inadequate on the battlefield.

Earlier work studied the effect of noise and stress induced by workload and physical forces on the performance of speech recognition systems. The efforts generated several standardised databases of speech in noisy environments. These databases were released widely in university and other scientific and industrial communities and used to evaluate the utility of commercial and developmental speech recognition systems in solving military problems.

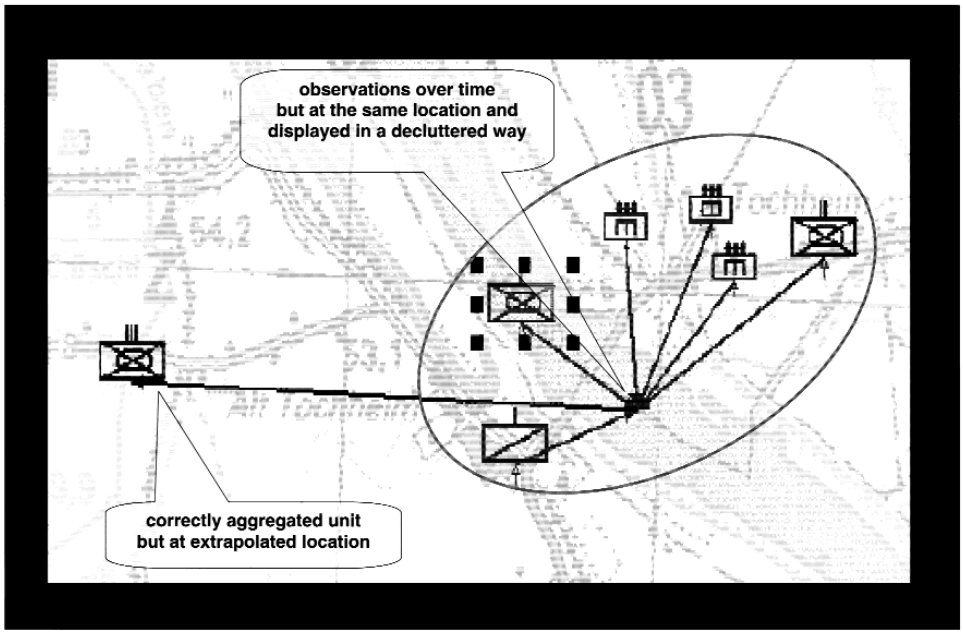
The databases have also been used by other NATO groups to evaluate speech technology such as speech coders and to prepare a NATO Standardization Agreement (STANAG) on a vocoder, such as may be used in a low-bandwidth combat net radio. Current work is investigating the effects of non-native accents on the performance of speech processing systems. With the cooperation of various military training centres, a database of standard radio operator phrases spoken in non-native accents is being prepared.

Data Fusion

The final operational evaluation of the 7-nation (Canada, Denmark, France, Germany, Italy, the Netherlands, and United Kingdom) NATO Data Fusion Demonstrator took



Application of Speech Technology to Voice-controlled Piloting of an Aircraft



The Data Fusion Demonstrator system is able to correlate multiple returns over a period of time from a given area and sensibly aggregate them into a single unit with its position extrapolated to the present time.

The Data Fusion Demonstrator System

place in the Italian Artillery school at Bracciano in September 1999. The objective of the original project was to investigate if automated data fusion could be of benefit to the Army Intelligence Officer. During the operational evaluation, three intelligence cells, each manned by an analyst, and using the Data Fusion Demonstrator automated processes, were able to produce more accurate and timely results than achieved by the five-person cells using manual fusion.

Although the exercise showed that automated data fusion is useful in increasing the capability of an intelligence cell, there remain limitations on its present performance. Major gaps still exist between the way the data is fused and displayed and what the analyst needs for situational awareness, analysis, and prediction. The Information

Fusion task group of IST is building on this core of expertise and will concentrate on the problem of information fusion for Situation Awareness and Threat Assessment within an all-source intelligence cell of a Joint Task Force HQ, deployed in operational level Peace Support Operations.

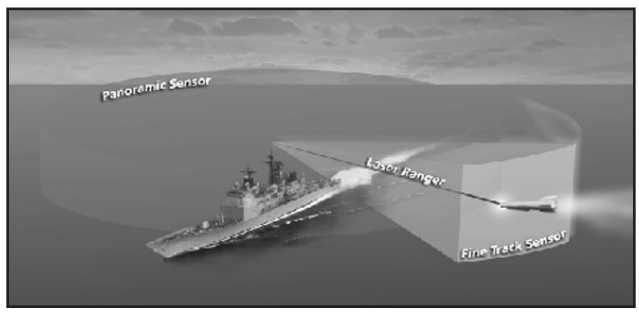
Sensors and Electronics Technology Panel (SET)

The mission of the Sensors and Electronics Technology Panel is to advance technology in electronics and active/passive sensors as they pertain to Reconnaissance, Surveillance and Target Acquisition (RSTA), Electronic Warfare (EW), communications and navigation, and to enhance sensor capabilities through multi-sensor integration/fusion.

Low Grazing Angle Clutter

The Panel held a Symposium in April 2000 to bring together theoreticians, modellers, experimenters and radar system engineers to assess the state of our present capabilities and requirements in the area of low grazing clutter characterisation. The characterisation and measurement of low grazing angle surface scattering (clutter) has long been an area of concern to the military.

Clutter is an annoying source of interference when attempting to operate in the low grazing angle mode, e.g., when the radar antenna main lobe is pointing almost parallel to the surface of the earth. This particular geometry has historically presented major problems to scattering theorists, modellers and experimenters in their



Staring Infrared Panoramic Sensor

quest to understand the primary causes of low grazing clutter. However, recent advances in numerical modelling and the use of highly precise stabilised platforms have presented new opportunities to characterise and understand the mechanisms of low grazing angle clutter. We are now able not only to measure this phenomenon precisely, but also to predict it from modelling, and the meeting reviewed just how our new capabilities in the areas of measurement, modelling and understanding will aid the radar designer in extending the functional range of both new and existing radars.

Maritime Infrared Target Signatures

A Task Group which concluded its work last year addressed the vulnerability of military ships to IR homing missiles. The main research topics related to ship self-defence and included the detection of anti-ship missiles using passive IR search and track sensors, ship IR signature management and field testing of candidate IR measures and countermeasures. Member nations were Canada, Denmark, France, Germany, Greece, Italy, The Netherlands, United Kingdom and United States.

This forum provided for the regular exchange of information on national research and development activities related to ship self-defence. Through the efforts of all countries, an IR ship signature code called SHIPIR was upgraded to meet NATO standards and is currently used as the baseline model by NATO countries. In recent years, this model has undergone extensive validation and has resulted in an increasingly accurate model with each release of the software.

The committee has also addressed the development of an accurate IR atmospheric radiation transfer model called Infrared Boundary Layer Effects Model (IRBLEM), an IR background model called IRTool, and a standard IR environment to use as a baseline for IR ship signature modelling and testing. The Group has published and distributed IR informational brochures for Navy personnel who are not IR specialists but need to know the variability of IR ship signatures and the effects of the marine environment on IR sensors.

Systems Concepts and Integration Panel (SCI)

The mission of the Systems Concepts and Integration Panel is to advance knowledge concerning advanced systems concepts, integration, engineering techniques and technologies across the spectrum of platforms and operating environments to assure cost-effective mission area capabilities. Integrated defence systems, including air, land, sea and space systems (manned and unmanned) and associated weapon and countermeasure integration are covered.

Military Denial and Deception (D&D)

The classified Workshop on future aspects of D&D, which was held earlier this year, had two primary objectives. One was to identify mechanisms to promote new D&D concepts, technologies, techniques and practices within NATO's military, intelligence, programmatic and technical communities, based upon recent combat operations and to generate advocacy for NATO-sponsored D&D R&T initiatives. The other was to identify the impact on NATO's operational capabilities and force employment operations.

The most significant payoffs were an overall improved awareness of the D&D impact on efficient and effective military operations and techniques for improved survivability of in-place and deployed operational forces through the use of proven D&D technologies and processes. The workshop also agreed a roadmap on how to meet the NATO cooperative research needs for implementing further system research, development, and increasing advocacy for improved D&D capabilities and operational applications. The workshop definitely met the goal of showing how to enhance mission effectiveness while operating in a D&D combat environment, and also promoted an understanding of the importance of D&D by potential hostile forces, particularly within the intelligence community which had not been a significant player in the R&T efforts in this field in the past.

This workshop has led to a subsequent workshop on "Realisation and Evaluation of Multispectral Decoys for Land Equipment" which will take place in August 2001 in Germany. This new workshop will compare the D&D practices from both sides of the former Iron Curtain, with speakers from the United Kingdom and Poland contrasting their past and present training in the importance and use of D&D. The workshop this year has also led to the formation of at least three future task groups of experts on "Enhancement of Camouflage Assessment Techniques", on "Multispectral Camouflage for the Soldier System" and on "Automated Infrared Camouflage Pattern Generation".

Future Precision Strike Missile Systems

The recent Lecture Series on technologies for such systems had three objectives. Two were to identify significant developments in the enabling technologies and provide examples of the advances in on-board processing, sensors utilising IR and millimeter wave RF, automated systems and high-speed materials and propulsion. The third was to address the challenging requirements for time critical targets, high kill probability, no collateral damage, high survivability and affordability. There were over 200 participants from nine nations, including three Partner Nations, in the three lecture series sessions held. This educational forum was such a success that it will be repeated in four more nations in 2001, including three Partner Nations.

Artist's conception of an air-breathing hypersonic missile just after launch from the parent aircraft

Applied Vehicle Technology Panel (AVT)

The aim of the Applied Vehicle Technology Panel is to improve the performance, affordability and safety of existing and future vehicle systems through the advancement of appropriate technologies. Building on a solid heritage from the aerospace-oriented former AGARD, AVT has successfully expanded into the land and sea environments and has moved into developing technological advice and solutions for operational problems. One example of this is an ongoing RTO Task Group which is analysing the "Technological and Operational Challenges associated with the Single Fuel Concept" (in accordance with the NATO Fuel and Lubricants Working Group).

Ageing Vehicles

In addition to work on modern technologies, such as hyper-speed vehicles, AVT also provides advice and solutions for the rejuvenation of existing systems. In Spring 1999 a very successful workshop on "New Metallic Materials for the Structure of Ageing Aircraft" made state-of-the-art information available across NATO Nations. More importantly, open topics relating to affordability were identified at this workshop, namely:

- integrating smaller units into larger substructures
- the question of cost saving through qualification by analysis for rebuilding of vehicles
- the cost-benefit issue of applying new materials to existing structures

The AVT Panel has taken up these topics. For November 2000 two special educational events on ageing vehicles have been arranged and are to be held in Bulgaria and Poland.

Uninhabited vehicles

Uninhabited vehicles (UVs) have also been an important part of the AVT Panel's work during the past year. Technology now permits the development of UVs that can do increasingly complex tasks in land, sea and air environments. AVT has established co-operation with NAFAG and NNAG to gain a better understanding of the operational concepts of use for these vehicles. Within a coalition operation it is important to have a common ability to work with UVs. A very successful Technical Course was held at the Belgian von Kármán Institute at the end of 1999 in which available knowledge on the "Development and Operation of UAVs (uninhabited armoured vehicles)" was conveyed to a selection of engineers from NATO Nations and the Ukraine. An AVT Symposium on UVs will be held in October 2000 in Turkey, which has a special interest in UVs. Around 300 participants from NATO Nations are expected to attend. Presentations will be made on the latest technology advances and discussions held on the way ahead for UVs.

Human Factors and Medicine Panel (HFM)

The Human Factors and Medicine Panel is the only Panel to focus specifically on the human. The Panel fosters high quality research in the area of the human operator in technologically rapidly evolving environments, and

thereby it plays a crucial role in generating the human-centred expertise that is necessary for a successful integration of humans and military technology.

It is increasingly recognised that the human is not just a limiting factor in highly advanced technological systems, but is, more often than not, a decisive enabling asset. In broad terms, the Panel seeks to optimise human performance, health, well being, and safety in military operational environments. In order to accomplish this, the Panel examines physical, physiological, psychological, cognitive and medical issues in order to understand and ensure the compatibility of military personnel, technological systems, missions and environments.

Usability of Information in Battle Management Operations

This Symposium held in Spring 2000 in Oslo, Norway, focussed on the ever increasing complexity of command and control (C&C) operations. While information technology is evolving at an unprecedented pace, yielding impressive capabilities, a tremendous informational and perceptual burden is placed on commanders, controllers, and warfighters. When system developers fail to consider the mutual effects of cognitive, informational, social and contextual factors, there is an increased probability of incidents, accidents and failures. However, with new collaboration and visualisation technologies, it is possible to increase the perceptual, cognitive and information utility of C&C systems.

There was general agreement that it is imperative that C&C system designers interweave collaboration and visualisation technologies with a deep understanding of how humans perceive and process information, make decisions and interact with computer interfaces, and of how users function in individual and collaborative environments. This combination of knowledge of human capabilities with technology advances offers the promise of providing mission- and task-critical information that is easily used by battlespace managers and warfighters.

Operational Medical Issues in Chemical and Biological Defence

This symposium will be held in Spring 2001 and is co-sponsored by the NATO Joint Medical Committee and the NATO Cell for Weapons of Mass Destruction (WMD). It is also being coordinated with the NATO Scientific and Environmental Affairs Division's Panel on Security-Related Civil Science and Technology. The HFM Panel believes that the end of the cold war has resulted in what appears to be a release of past inhibitions against WMD by some potential adversaries. As a consequence, there is a need for significant change in the way NATO addresses the issue of the protection of military and civilian populations. The spread of WMD (biological and chemical), both among nations and terrorist groups, creates a threat to civilian and military populations, and protection and medical management of exposed populations poses major challenges to both civilian and military medical systems. This Symposium will bring together the combined military and civilian expertise of the Alliance in order to evaluate current knowledge, protection capabilities and plans for countermeasures, and to identify deficiencies.

Communication under Difficult Conditions

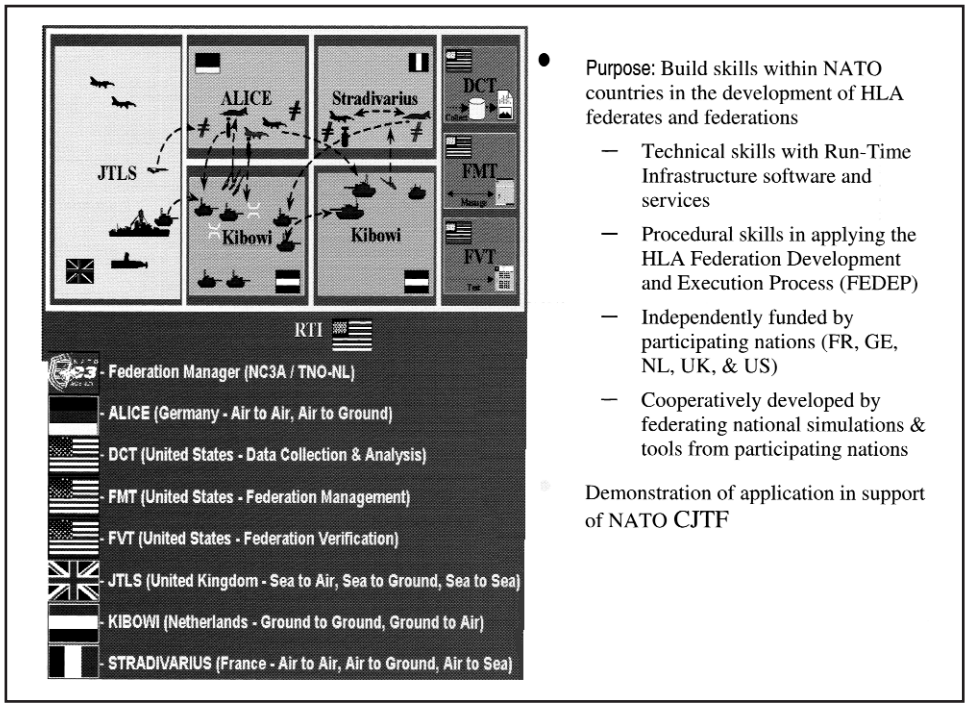
NATO Modelling and Simulation Group (NMSG)

The NATO Modelling and Simulation Group is a new organisation within the Research and Technology Agency which has been endorsed by the North Atlantic Council to implement the NATO Modelling and Simulation Master Plan. The increasing importance of Modelling and Simulation (M&S) has now been recognised within NATO to provide readily available, flexible and cost-effective means to dramatically enhance NATO operations in the application areas of defence planning, operational planning, training and exercises, support to operations and modernisation. A number of programmes of work have now been initiated to implement the Master Plan.

Training, Education and Enhancement Programme (TEEP)

The Military Committee approached RTA early in 2000 to undertake a fast reaction, high priority study to evaluate existing and developing techniques and opportunities for NATO & PfP on Distance Learning and Simulation to help Partners train more in depth and promote interoperability. Aspects to be investigated were the infrastructure, content, cost and timescales of implementing a comprehensive electronic and secure network to support planning, execution and feed-back.

An Interim Report, providing initial recommendations and conclusions, has been delivered on schedule. A final report, together with a demonstrator of distributed learning, training and exercising capability, will be presented to the Military Committee in November 2000.



DiMuNDS 2000

NMSG has demonstrated a fast reaction capability in undertaking a feasibility study and providing a demonstration of capability in less than one year which will enable the Military Committee to decide on fast track implementation programmes to benefit NATO, the Nations and PfP.

DiMuNDS 2000 and Follow-on Pathfinder Programmes

DiMuNDS (Distributed Multi National Defence Simulation) is a highly successful project where five Nations have contributed individual National simulations and are building a federation, in conjunction with NC3A, SHAPE and SACLANT, using the High Level Architecture (HLA). This project provides the basis for developing skills and experience in NATO nations in the cost effective re-use of software using the HLA. The federation will also be demonstrated later this year in a military application that supports the highest priority identified in the M&S Master plan, that of supporting the NATO Combined Joint Task Force. The federation provides the basis for undertaking a Computer-Assisted Exercise which offers very significant cost savings and effectiveness benefits when compared with undertaking Live exercises.

LONG TERM STUDIES

Three studies of the future have been carried out. Each adopted its own approach, but they all had as their basic aim the identification of the likely changes to the battlefield (sea, land or air) as a result of potential new technologies, and the steps that needed to be taken by the military and the research bodies of NATO and the NATO nations to ensure an effective fighting capability in the future.

Maritime Operations 2015 studied twelve representative scenarios to provide a backdrop for identifying shortfalls in overall maritime capability and assessing their criticality, and then identified the most promising systems for reducing the key shortfalls in different warfare groups, such as Mine Countermeasures, Anti-Submarine Warfare, Amphibious Warfare, etc.

Land Operations in the Year 2020 determined the implications of new technologies in this sector by describing the nature of the 2020 battlefield and identifying the types, characteristics and required capabilities of land forces at that date, and the emerging technologies most likely to be of importance. It also recommended directions for R&D in support of land operations. Eleven top critical technology areas were defined, including novel electric technologies, robotics and automation, biotechnology, advanced materials and smart structures.

Aerospace 2020 assessed how emerging technologies may influence changes in aerospace systems and operational concepts, informed decision-makers of the advantages these technologies might have and the threats that might be presented by potential adversaries who acquired them, and recommended the most promising technologies to be pursued. Technologies determined as important included microtechnologies, microelectronics, nano-technologies, materials technology, information warfare, and space technologies.

An Artist's Conception of the Land Battlefield in 2020

A STRATEGY FOR NATO'S R&T

In March 1998 the Board set up a small team led by one of its members, Mr Ken Peebles of Canada (now Director of RTA), to develop a long-term R&T Strategy for NATO. The team's report was approved by the North Atlantic Council in December 1999, and RTA started to implement the Strategy earlier this year. It is complementary to the recently launched Defence Capabilities Initiative (DCI), and identifies three broad strategic elements by which NATO's R&T can contribute to NATO's overall objectives:

- Provide excellent research and technology to NATO and the nations
- Ensure flexibility and innovation of defence technologies
- Develop a common focus for NATO R&T

We confidently believe that the implementation of this Strategy will enable NATO and the NATO nations to maintain their technical edge in the twenty-first century.

Polish National Day

During the Board Meeting in Poland in Fall 1999, participants visited either the Telecommunications Research Institute or the Air Force Institute of Aviation Medicine. Everyone then visited the Military University of Technology, and were then invited to a barbecue at which they were joined by their companions. The latter had taken part in a rifle-shooting competition which was won by Mrs Rosaria Salzano, the wife of the SET Executive. It is hoped that these photographs, mainly taken from brochures kindly supplied by two of the organisations visited, will give a flavour of the day and of the work being undertaken.

Colonel Marek Amanowicz welcomed the party on behalf of the Rector of the Military University, stressing the value that Poland placed on its membership of NATO and saying that the University had welcomed the opportunity to demonstrate some of its work to the Research and Technology Board. He then presented a plaque to the RTB Chairman in honour of the visit (and Dr Yarymovych presented an RTO plaque in return).

Mrs Salzano with her rifle-shooting trophy. She had never shot before. Behind her is Dr Ken Street of Canada.

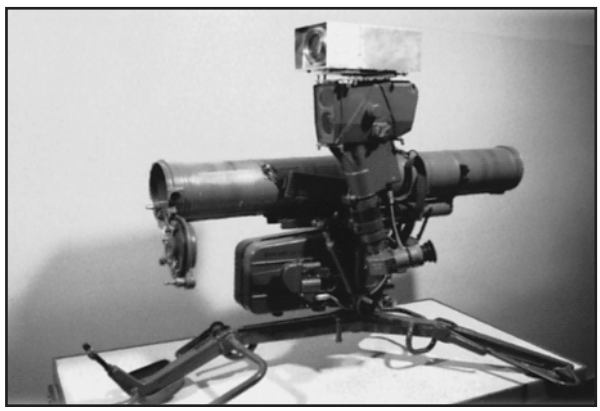
The party outside the University

The Military University of Technology

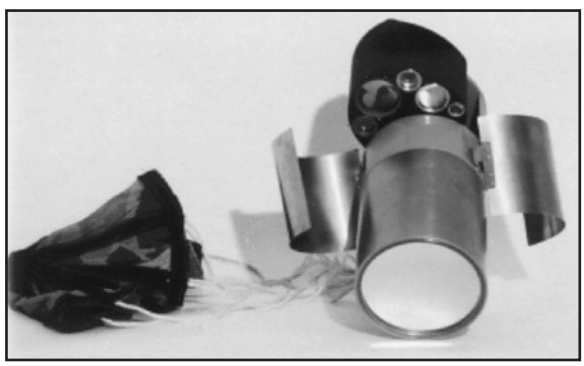
The University was established in 1951 and is now an integral part of the Polish science and national education system. Among its graduates, 84 have been appointed as university Professors and 40 have been promoted to the rank of General. There are five faculties: Cybernetics; Electronics; Engineering, Chemistry and Applied Physics; Mechanics; and Armament and Aviation Technology. In addition, there are four institutes: Command and Control Systems Automation; Humanities; Logistics; and Optoelectronics.

Some of the lethal weapons being displayed to the visitors

NEWA SC anti-aircraft system



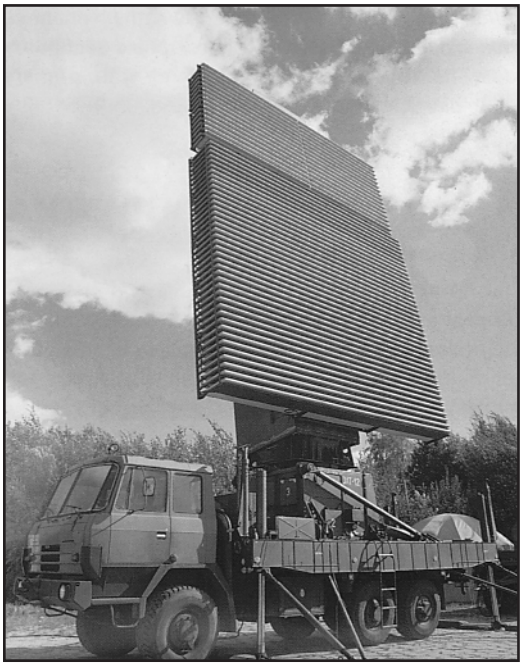
Anti-tank laser-guided missile launcher



Smart anti-tank submunition, ‘Meteor’

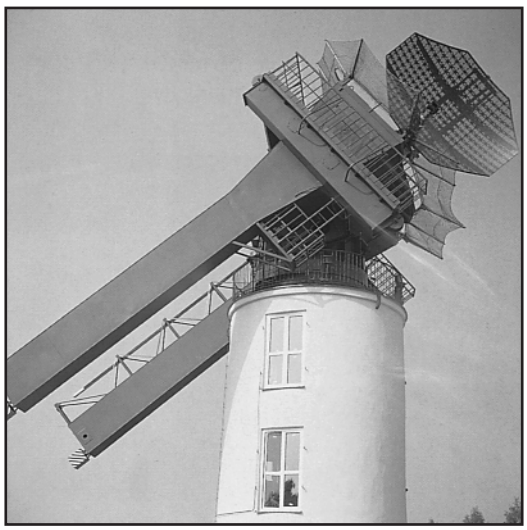
The Telecommunications Research Institute

The Institute was set up to carry out research into microwave technology in the 1930s and was closely connected with the development of the magnetron oscillator. Since the Second World War, it has been working on radars for nearly 50 years. Its other main area of activity nowadays is command, control, communications and intelligence systems.



Two mobile radars

Automated mobile command post



Antenna measuring tower

Automated radar intelligence post

Welcomed in Warsaw

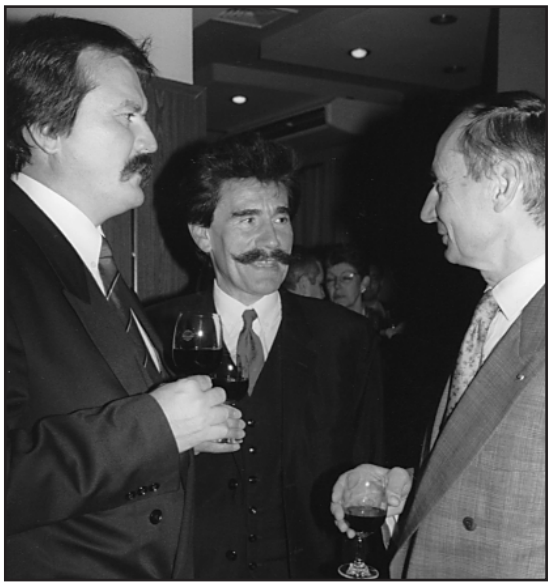
The Fall 1999 meeting of the Research and Technology Board marked the admission earlier that year of three new members to NATO by being held in one of them - Poland. The meeting, which took place during the week of 20 September, was held in a hotel on the edge of Warsaw. As well as the business meeting, a Technical Visit and the associated meetings, members were invited to a reception and a dinner. A very few of the more than 120 photographs taken during these activities follow. The Technical Visit is recorded elsewhere.

At the start of the meeting are, from left to right, Captain A. Simi, standing in for Mr Leira, the Co-Vice Chairman, who was unable to attend, Dr Michael Yarymovych, Chairman of the Board, Dr Ernst van Hoek, Director of RTA, and Maj. Gen. A Grønheim, Co-Vice Chairman. In the background are the minute writer, Mrs Diane Phaetos, and the Director's Secretary, Mrs Heather Laget.

The main host nation organisers: Professor K. Santarek, the senior Polish Board Member, of the R&D Department of the Polish Ministry of National Defence and Colonel S. Kwintal, Polish Coordinator at the time and now the senior Polish Board Member.

Dr Dolores Etter, the senior US Board Member, Deputy Under Secretary of Defense (Science & Technology) of the United States.

Two Canadian Board Members: Dr L.J. Leggat, Chief of Research and Development, DND, and Dr W. Wallace, Director General of the Institute for Aerospace Research of NRC.



Mr Bela Muranyi and Colonel T. Rath, Board Members from Hungary, talking to General Marc Pirou, the Head of Operations and Coordination Division at RTA.

Two Czech Board Members: Prof. J. Ploch, Director of the Air Force Research Institute, and Dipl. Ing. J. Janosec, of the Department of Assets, MOD.

Two Belgian Board Members: Prof. F.A.E. Breugelmans, from the von Kármán Institute, and Lt. Gen. A Van Daele, Deputy Chief of Staff for Logistics.

Two Danish Board Members: Maj. Gen. H-M Jelsdorf, Surgeon-General, and Dr P. Lawaetz, Director of the Defence Research Establishment.

As well as the Board Meeting proper, which is limited to NATO nations, there was also a special session for the Partnership for Peace nations. Four of the nations who gave presentations are seen below.

Sweden: Col. G. Dahlback and Dr O. Dahlmann. The latter gave a presentation on Science for Security in Sweden.

Lithuania: Dr S. Balevicius, who gave a presentation on the development of land mine detectors.

Bulgaria: Dr T.D. Tagarev, who gave a presentation on the consolidation of Bulgarian defence scientific and research activities.

Georgia: Maj. A. Burjanadze and Col. G. Tavadze. The latter gave a presentation on the wide scope of scientific and technological activities in Georgia, covering a very broad range of topics.

Another meeting taking place during the same week was the Integration Coordination Meeting, which includes the Chairmen of all the Panels, the NATO Modelling and Simulation Group, and the Information Management Committee.

SAS (Studies, Analysis and Simulation Panel): (at right) Mr René Willems, Panel Chairman, from the TNO, The Netherlands, and Dr Jacques Vermorel, the Executive and Head of the Brussels office of RTA.

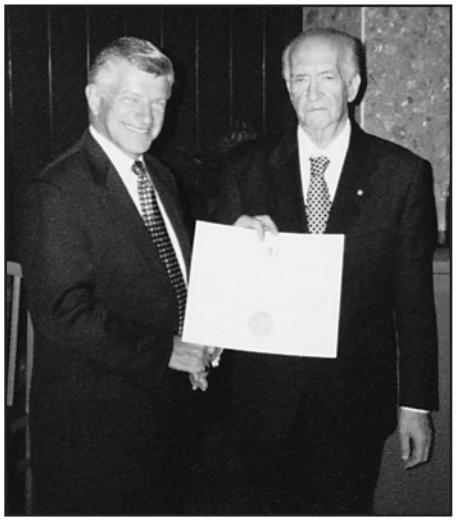
IMC (Information Management Committee): Dr Heinz Häge, of the Federal Armed Forces Technical Information Centre of Germany, and Mr George Hart, the Executive, who is also responsible for RTO publications. In the background are two National Coordinators, Mr Barry DeRoze, of the US, and Mr A. Skøelv of Norway.

Mrs Lana Yarymovych, wife of the Chairman (who is visible in the middle of the photograph) and Dr Ernst van Hoek, Director of RTA.

Mrs Christine Pirou, wife of the Head of OCD at RTA, Mrs Karin Frank, wife of the German National Coordinator, and Mrs Jolly van Hoek.

General J.R. Dailey of NASA, US Board Member, Mrs Mimi Dailey, and Maj. Gen. A. Grønheim, Assistant Director of the International Military Staff at NATO.

Mr Fernando Merida, National Coordinator of Spain, Dr Lawaetz of Denmark, Dr John Leggat of Canada, Mr Viggo Lemche, National Coordinator of Denmark, Mr Ken Peebles of Canada, Mr Dick Williams the NASA Coordinator for RTO (mostly hidden), and Mrs Christine Hart, wife of the RTA Executive for publications.

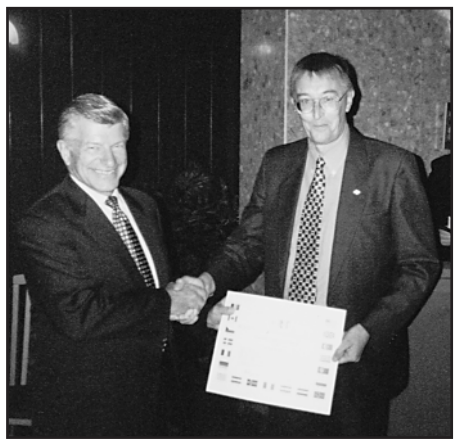


The von Kármán Medal and certificate were presented to Professor Paolo Santini of Italy. The full citation was given in Highlights 1999.

Teddy Houston, Head of Strategy and Policy Division at RTA, received a farewell certificate from the Chairman, with whom he had worked very closely during the preceding three years.

Signed certificates are presented to all participants in Board meetings who are attending their last meeting, and sent to those who have previously left. This means a considerable chore for the Board members who have to sign each one. Doing so here are Dr D.C. Daniel of the US and Dr Simon Calero of Spain.

Scientific Achievement Awards were presented to (left) Dr Herman Steeneken of The Netherlands, and Dr Roger Moore of the UK. The full citations were given in Highlights 1999.



The members were entertained by a very talented group of amateur dancers and musicians, all of whom were students at the Warsaw University of Technology.

French National Day

During the Spring 2000 Board Meeting, participants visited the French Test Centre, 'Centre d'Essais des Landes - CEL' at Biscarosse, south of Bordeaux. They were given a general presentation to the many test centres run by the French defence procurement agency, DGA, and specifically to the role of CEL, which has four sites south of Bordeaux and one in Brittany. Among other aspects, members were shown the facility for tracking test firings of missiles and the high-speed test track - alas not in use during the visit.

The party was welcomed by Ingénieur Chef de l'Armement Renvoisé, Director of the Centre

The 2000 metre track from a distance . . .

. . . and at close quarters

A selection of targets . . .

. . . and one flying

Tracking a missile the hard way . . .

. . . but it's easier like this!

A tracking antenna

It may have been Spring, but the wind from the Atlantic was cold!

The Centre also tests vehicles before the Paris-Dakar Rally

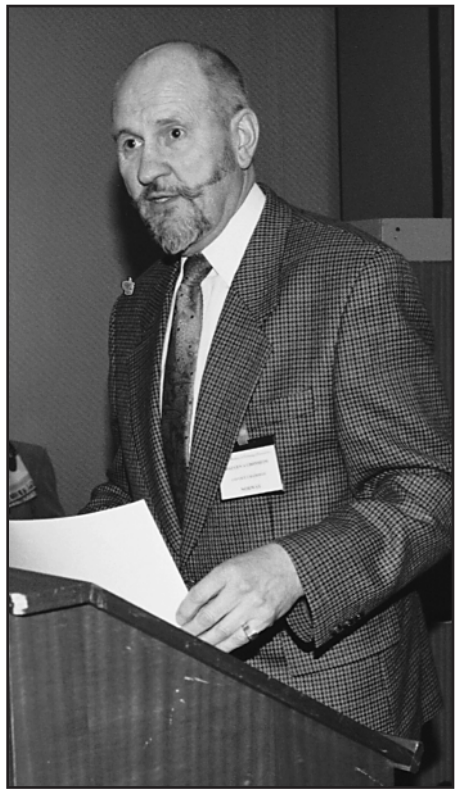
The Board in Bordeaux, March 2000

The Spring 2000 meeting of the R&T Board was held in Bordeaux, France. During it, participants were taken on a Technical Visit to the Centre d'essais des Landes. On the social side, they were also invited to visit a vineyard, Château Giscours, where they were given a guided tour, followed by a wine-tasting and dinner. The following photographs are intended as a small reminder of these days. The Technical Visit is recorded elsewhere.

Part of the 'Top Table' at the Board meeting, from left to right, Mr Robert Bell, Assistant Secretary General for Defence Support at NATO, Dr Michael Yarymovych, Chairman of the Board, and Dr Ernst van Hoek, Director of RTA.

Lt Gen Kandborg, Director of the International Military Staff of NATO, who gave a speech that is recorded elsewhere in this issue.

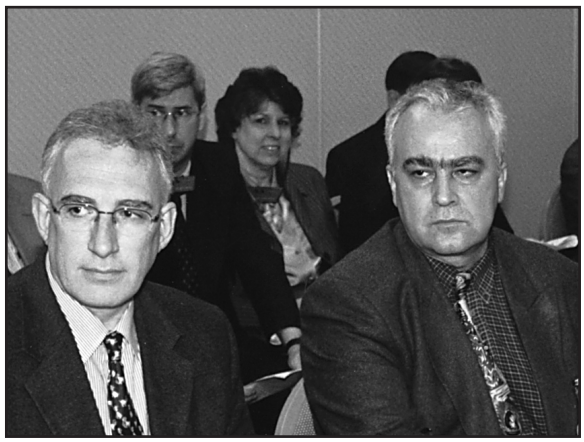
Mr G. Leira, Deputy Assistant Secretary General in the Defence Support Division and Co-Vice Chairman of the Board, Ingénieur Général de l'Armement D. Estournet Board Member from France, and Brigadier Général Y. Chaminadas, also of France.



Major General A. Grønheim, Assistant Director, responsible for Logistics, Armaments and Resources in NATO, the other Co-Vice Chairman, whose last meeting it was, holding his farewell certificate and addressing the Board for the last time.

Two Board Members from Germany: MinDirig. D. Ellinger and Professor V. Von Tein.

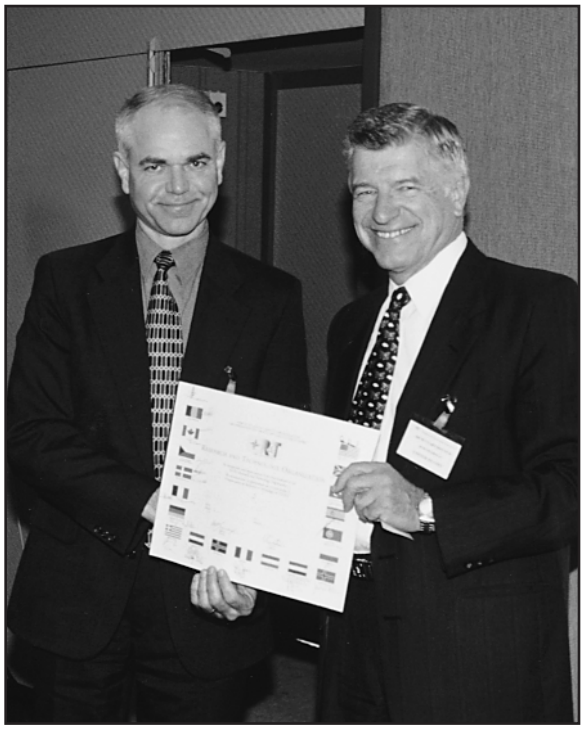
Two Board Members from Norway: Dr J. I. Botnan and Mr N. Holme.



Two Board Members from Greece: Mr I. Germanidis and Mr K. Zarpas.

Two Board Members from Italy: Maj. Gen. P. Finocchio and Dr A. Airaghi; and Dr R. M. L. Schipolt who is representing the Netherlands.

Two Ex-officio Board Members: Professor W.I. McFarlane, Chairman of the NATO Industrial Advisory Group, and Mr A.T. Cooper, Executive Coordinator and Deputy to the Director of the NATO HQ NC3 Staff.



A leaving certificate was presented to Brig. Gen. A. Thrasher (US), Ex-Officio RTB Member from SHAPE.

A leaving certificate was also presented to Professor Koerner (GE), Chairman of AVT.

Two Canadian Board Members: Mr Ken Peebles, R&D Advisor to the Department of National Defence (who was attending his last meeting as a Board member before becoming RTA Director) and Dr W. Wallace, Director General of the Institute for Aerospace Research.

Two Spanish Board Members: Mr A. Jara Albarran, Deputy Director of R&T in the Ministry of Defence, and Dr L.P. Ruiz Calavera of INTA.

Four Belgians: Professor F.A.E. Breugelmans, of the von Kármán Institute, Col IMM T. Fouyn, of the R&T General Staff, Lt Général A. Van Daele, Deputy Chief of Staff for Logistics, all Board Members, with the National Coordinator, Lt Col A. Husniaux in the background.

Recording the meeting for posterity: Mr Gary Appleton is Secretary to the Board (and Assistant Director of RTA), and he is ably assisted by the Minute Writer and the Director's Secretary.

These two photographs show the change-over of Chairmen at the end of the meeting: Dr Yarymovych handing over the (rarely used) gavel to Mr Nils Holme, the incoming Chairman, and Mr Holme performing his first official duty by presenting a leaving certificate to Dr Yarymovych.

The following photographs show the dinner at the Château Giscours

A general view of the party during the 'technical visit' before the dinner.

Lt General Kandborg, Director of the International Military Staff of NATO, was guest of honour and spoke about the future of NATO's Research and Technology (recorded elsewhere in this issue).

General Kandborg was seated between Dr van Hoek and Dr Yarymovych. Also on the same table were Mrs Leena Holme, wife of the incoming Board Chairman, who is talking to Mr G. Leira, Co-Vice Chairman (seen more clearly in the right hand photo), next to whom are ICA Renvoisé, Director of the Centre d'Essais des Landes where the members had previously had a technical visit, and Mr Ken Peebles, the incoming RTA Director.

Mrs Jolly van Hoek, who was attending her last meeting, Major General Grønheim, Co-Vice Chairman, and IGA D. Estournet, French Board Member . . .

. . . continuing from the previous photo are Général Estournet again, Mr Nils Holme, incoming Chairman, and Mrs Lana Yarymovych, also attending her last meeting.

Col T. Rath, Professor J.P. Ploch and Commodore Ir D. van Dord, Board members from Hungary, the Czech Republic, and the Netherlands, and Mr Barry Dyke, Chief of Finance at RTA, whose first RTB meeting this was.

Mrs Susan Muranyi and her husband, Belá, Board Member for Hungary, Mr Barry DeRoze, US National Coordinator, Lt Col Dick Vantine (US), Executive Officer of the Operations and Coordination Division of RTA, and Dr Jacques Vermorel, Head of the Technology Studies and Cooperation office of RTA (based in Brussels).

Lt Col Husniaux and ICA P. Cunin, National Coordinators from Belgium and France, Mr J.C. Mabberley, UK Board Member from DERA, and Mrs Mary Walker (UK), Chairman of the Human Factors and Medicine Panel.

From left to right are Mrs Magda Van Daele, Lt Général Van Daele, Board Member from Belgium, Mrs Heidi Tonn, Dr Peter Tonn, AVT Executive, and Mrs Karin Frank, wife of the German National Coordinator.

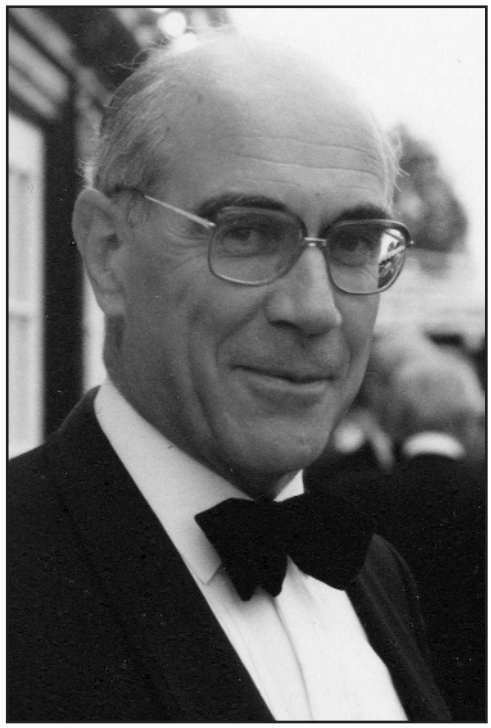
From left to right are Lt Col Philippe Soète (FR), Executive Officer for Strategy and Policy Division of RTA, Mrs Ester and Dimitris Stamatopoulos (GR), who is responsible for the PfP programme at RTA (Brussels), Mrs Christine and Major General (rtd) Marc Pirou (FR), Deputy Director of RTA.

Mr Gary Appleton, Assistant Director of RTA, is with his wife, Sheron, and Mrs Diane Phaetos, the Board minute writer.

The RTO Family

In this section, we put news about present or past members of the RTA, AGARD and DRG families, and we welcome items for printing.

Professor John Scott-Wilson, OBE FREng FRAeS



It is with great regret that we learned of the sudden death, peacefully in his sleep, of Professor John Scott-Wilson on 11 January 2001. Professor Scott-Wilson played many roles in AGARD, one of the forerunners of RTO, and was involved in the first steps leading towards the formation of the RTO. He was Chairman of the Flight Mechanics Panel from 1971 to 1974, and (at the same time) was the first Chairman of the Aerospace Applications Studies Committee. He was awarded the von Kármán Medal in 1975, and was appointed a UK National Delegate to AGARD from 1982 to 1994, serving as Chairman of the Board for the last three years of that period. We offer our sincere sympathy to his widow, Andrea, and his family.

We should like to thank John's son, Tim, for having kindly supplied contributions by Professor Ian Poll, of Cranfield University, a close friend, and another son, Chicker, from which we have prepared the following note. Any errors are, of course, ours.

John Scott-Wilson was an Aerospace Engineering and Business Leader who helped to shape Civil and Military Aviation. A leading, international figure in the aviation and aerospace fields for over 40 years, he was involved in the design and development of some of the UK's most successful aircraft and played an important role in the evolution of the UK aerospace industry.

Born in December 1927 in Bromley, Kent, the son of a doctor and one of five children, he received his early education at Sutton Valence school. In 1940, like so many of his generation, he watched the critical air battle being fought overhead. One day, whilst standing on a local hill, he found a German aircraft flying very low and straight at him, with an RAF fighter in hot pursuit. The closeness of this encounter left an enduring impression on him and may well have influenced his choice of career.

In 1945, he went to Cambridge University where he obtained first class honours in Mathematics and Mechanical Sciences. The late 1940s were heady times in aeronautics, with the first generation of military jet aircraft newly in service and a number of ground-breaking projects, both military and civil, in development. The science of aerodynamics was developing rapidly, and the academics at Cambridge were amongst the best in the business. He was exposed to the pioneering work of Professor Melvill Jones and Dr Harry Preston and this clearly had a bearing on his choice of specialist subject.

After leaving Cambridge in 1950, he joined the Royal Aircraft Establishment at Farnborough as a Scientific Officer in the Aerodynamics Department. This was followed by a move to Bedford, where he worked with the newly commissioned transonic/supersonic wind-tunnel; the first large scale, supersonic test facility built in the UK.

In 1956, he moved to industry, joining A V Roe and Company as Deputy Head of Wind Tunnels, where he worked initially on modifications to the Vulcan leading edge to improve its high altitude, high Mach number performance. He was appointed Chief Aerodynamicist in 1959 and was responsible for the aerodynamic design of the AVRO 748 twin turboprop airliner and conducting early studies to develop the replacement for the Shackleton maritime reconnaissance aircraft - a project that would eventually become the Nimrod. In 1966, he was made Chief Projects Engineer of Hawker-Siddeley Aviation, Manchester, dealing with military and civil V/STOL projects. Two years later, he became Assistant Chief Designer and Head of Technical Services. The hectic period from 1968 to 1972 saw the launch of the military version of the 748, known as the Andover, the Nimrod, and also the initiation of work on a large military transport that would lead directly to the Airbus A400M project. In 1972, as a result of his continued success, he became an Executive Director of Hawker-Siddeley Aviation and Deputy Chief Engineer.

Following the formation of British Aerospace in 1978, he was appointed Technical Director of the Manchester Division with responsibility for the Nimrod maritime reconnaissance and airborne early warning programmes. In 1982, as a consequence of the Falklands conflict, he was tasked with providing the Nimrod with an air-to-air refuelling probe, a modification that took just 18 days to initial operational clearance. This was followed by the conversion of six Vulcan bombers into in-flight refuelling tankers and giving the Nimrod the ability to carry Sidewinder and Harpoon missiles.

Overall, the work took less than 40 days to complete and it was a major engineering achievement to deliver the modifications in such a short time. In the major reorganisation in 1984, he became Technical Director of the Weybridge Division and this brought responsibility for the Harrier and Hawk programmes plus the Airbus A320 wing. Yet more developments led to his being made Technical Director of the Civil Aircraft Division and, finally, Technical Director of the BAe Commercial Aircraft Company. These appointments led to involvement in the BAe 146, ATP and Jetstream aircraft, not to mention the Airbus wing family. He retired from British Aerospace in 1991.

Whilst Chairman of the AGARD Board, he oversaw monumental and historic changes, notably the first contacts with the aerospace communities in the former Warsaw Pact countries and the first joint symposium held in Moscow in 1994. He also found time to be a member of the Civil Aviation Authority's Airworthiness Requirements Board from 1984 until 1998, being the Chairman from 1994.

Following his retirement from British Aerospace, he began to devote time to the development of aerospace activities in higher education. The transfer of the AVRO low-speed, wind-tunnel (the facility that brought him to Manchester 35 years earlier) from BAe to Manchester University began a happy association that was to last for 10 years. The Aerospace Department was in the process of developing links with industry and he was easily persuaded to provide a course of 10 lectures on "The Aerospace Industry" for first-year students, and was appointed Visiting Professor in 1992. However, his involvement was to go much deeper. The arrival of the new tunnel brought the prospect of commercial exploitation and, on the back of a substantial contract for racing car work, a company was formed as a technology transfer company wholly owned by Manchester University, with John Scott-Wilson as a non-executive Director.

In 1994 he moved to another part of England, becoming a Visiting Professor at Cranfield University, where he played a key role by acting as a sounding board for ideas and providing advice and assistance whenever it was requested. His contribution was crucial to the revitalisation of the College of Aeronautics. In particular, in the College's 50th anniversary year, his help in arranging for astronaut Neil Armstrong (a former US National Delegate to AGARD) to be the special Honorary Graduand was much appreciated and will be long remembered. Most recently, as non-executive director, he played a full and important role in the development of a company formed within the College of Aeronautics to trade in the commercial domain.

His enormous contributions to the profession were recorded in a number of ways. Apart from the von Kármán Medal, mentioned above, he was elected a Fellow of the Royal Aeronautical Society and was awarded the Society's Silver Medal in 1984, followed by the Gold Medal in 1993; a combined honour bestowed on very few individuals. He was elected to a Fellowship of the Royal Academy of Engineering in 1985 and awarded the OBE in 1987. However, these formal honours give only a partial indication of the calibre of the man himself. To those privileged to know him well, he was a man with a razor sharp intellect, who could, and did, speak his mind when the occasion warranted it. He was a powerful friend and ally, who gave his time willingly and without hesitation. He was very good company, fun to be with and he enjoyed vigorous, academic debate on technical issues.

In 1951 he married Elizabeth Grant-Ives (Etty), a nurse whom he had met in hospital at Cambridge, when he had cut his leg trying to climb over railings to get back into college after the gate had been locked. Their first home was a houseboat, and the midwife who came for the birth of their first son fell off the gangplank - whether before or after the birth, we don't know. At any rate, they moved to dry land shortly afterwards. Etty died in 1992. Their four sons and his second wife, Andrea, all survive him.

Time Off – for the Panels and other Bodies to be photographed during their meetings.

The Information Systems Technology Panel (IST) met in Brussels, Belgium, in Spring 2000

The Systems Concepts and Integration Panel (SCI) met in Valencia, Spain, in Spring 2000

The Applied Vehicle Technology Panel (AVT) met in Braunschweig, Germany, in Spring 2000

The Information Systems Technology Panel (IST) met in Istanbul, Turkey, in Fall 2000

The NATO Modelling and Simulation Group (NMSG) met in Shrivenham, UK, in Fall 2000

The Information Management Committee (IMC) met in Budapest, Hungary, in Fall 1999

Arlette Person

It is not often nowadays that someone works in the same organisation for nearly 40 years, and so 24 February 2000 was a special day because Arlette Person left RTA on that date after having worked there and in AGARD for 38 years. This is a shortened version of thoughts she expressed when leaving.

Départ ... ou arrivée?

En ce 24 Février de l'année 2000 débutant un nouveau millénaire, je suis très émue et j'apprécie beaucoup de vous voir tous réunis pour fêter cet événement unique à la fin d'un chemin de 38 années au sein de notre organisation.

J'ai sans doute conduit ma voiture trop vite, mais du mieux possible : la circulation fut intense au long de ce parcours. Assurément, j'y ai croisé un grand nombre de véhicules de toutes sortes conduits par des chauffeurs impétueux et plus ou moins habiles : cela n'est pas toujours facile d'éviter leurs manœuvres ou de supporter des embouteillages! Les conditions de circulation ont aussi été perturbées par des intempéries, des orages, des coups de tonnerre mais heureusement aussi de grandes étendues de ciel bleu. Ces années souvent passionnantes furent bien remplies car ni le courage ni l'énergie n'ont manqué !

Aujourd'hui je suis tentée de donner un coup d'œil dans mon rétroviseur : j'y aperçois le remarquable Professeur von Kármán - fondateur de l'AGARD. Je m'en souviens parfaitement : j'étais jeune à l'époque et je pensais que tous les « AGARDiens » étaient d'âge mûr …voire très mûr (non! je n'ai pas dit trop mûr!). Je les admirais et je les respectais beaucoup : à mon tour, je suis peut-être comme eux, devenue aujourd'hui….respectable et pas trop mûre….

Ceux qui ont pu approcher le Professeur von Kármán se souviennent forcément que malgré son rang élevé, il avait toujours une attention particulière et sympathique pour chaque membre de son équipe quel que soit son grade.

En ce jour, je préfère laisser de côté les déceptions et regrets pour n'évoquer devant vous que les moments privilégiés dont j'ai bénéficié. Je tenterai également de formuler quelques souhaits. Tout d'abord, qu'il me soit permis ici d'exprimer égoïstement ma très grande satisfaction de bénéficier de ma retraite : cette période, considérée à juste titre comme naturelle, est de nos jours pleine d'incertitudes, peut-être même remise en cause : un clin d'œil aux plus jeunes pour les inviter à s'y intéresser le plus tôt possible.

Eh oui, j'ai passé un peu plus de 38 ans à l'OTAN! (certains d'entre vous n'étaient pas encore nés au moment de mes débuts) et parmi des moments intenses, lors de nos réunions, le privilège de rencontrer d'éminentes personnes (je citerai notamment Neil Amstrong). Du fond du cœur, je remercie tous ceux et toutes celles avec qui j'ai eu la chance de travailler, qui m'ont supportée et qui m'ont souvent offert leur amitié lorsque je traversais des moments difficiles.

La chance m'a également été donnée de côtoyer, dans leur pays natal, des personnalités aux cultures et aux traditions différentes. Préparer nos réunions à l'étranger est passionnant et j'ai ressenti à chaque fois cette attirance naturelle qui me servait de dynamique. Je souhaite à toutes mes collègues d'être pleinement reconnues pour leurs compétences souvent mises à rude épreuve.

Tout en ayant à cœur
d'effectuer mon labeur
au cours de ces années,
j'ai eu la chance de rencontrer l'âme sœur.

Nous avons pu ensemble réaliser déjà de nombreux projets et je suis persuadée que mon équilibre familial a contribué à mon dynamisme.

Je quitte mon rétroviseur pour conduire plus sûrement, et sereinement vers la nouvelle vie qui s'ouvre devant moi. Je dois me préparer pour une bonne quarantaine d'années si j'en crois mes statistiques familiales plutôt favorables : en effet, ma mère a vécu 90 ans et mon grand père (à un mois près), a vécu 103 ans. Pour la petite histoire, sa période de retraite a été plus longue que ses années d'activité … Le service des Retraites de l'OTAN n'est pas prêt de m'oublier!

Je me sens toujours prête à foncer sur les routes par tous temps comme d'habitude (notre regretté M. Borgeaud m'avait surnommée « Speedy Gonzalés »), à monter les étages chez mes enfants grâce à mon entraînement pour leur apporter le bénéfice de ma liberté.

Ma conclusion s'inspire d'une chanson de Charles Trenet mise au féminin pour la circonstance et intitulée : « Drôles d'Idées » [imprimée à la page 53].

Translation – prepared by the author

Departure . . . or arrival?

Today, February 24th of the year 2000, the beginning of a new millennium, I am deeply moved and extremely touched by your presence here to celebrate a unique event, I mean the end of a 38 year long career within our organisation.

Maybe I drove my car too fast but as well as I could; the traffic was heavy throughout my years of work. For sure I came across a large number of vehicles of all kinds driven by impetuous and not always skilful people. It is not always easy to avoid their movements or to put up with traffic jams. Traffic conditions were also disturbed by bad weather, storm claps of thunder but fortunately there were large stretches of blue sunny sky. All these years, often very exciting, were busy and indeed full of energy and courage.

Today I am tempted to look in my rear view mirror and see a remarkable man: Professor von Kármán, the founding father of AGARD. I remember that period very well: I was young at that time and I thought that all the "AGARDians" were middle aged or even older (mind you I didn't say too old). I admired and respected them a great deal and in turn have become….respectable, and perhaps not too old….

Those who met Professor von Kármán cannot help remembering that in spite of his high position, he always paid attention and expressed his friendliness to every member of his team, whatever their rank.

Today I shall leave aside disappointments and regrets to tell you only about the privileged moments I experienced. I shall also try to express some wishes. Do allow me, first of all, to say very selfishly how glad I am to retire. This part of life considered as natural - and very rightly so - is nowadays full of uncertainties and perhaps even called into question. I say this, hoping that the younger people will give this issue a thought earlier in life.

Well, I spent a little more than 38 years at NATO (some of you were not born yet when I started) and experienced intense moments when I had the privilege to meet eminent personalities during our meetings (Neil Armstrong for instance). I would like to thank, from the bottom of my heart, all those with whom I have worked and put up with me and often gave me their friendship when I went through difficult moments.

I was also offered the possibility to meet personalities in their native countries, with different cultures and traditions. The preparation of our meetings abroad was a very exciting experience and my natural attraction to what is foreign worked as a catalyst. I wish my colleagues will have their competencies fully recognised, which is not always the case.

Also having at heart the need to work
In the course of these years I met with my dear.

Together we were able to do a lot of things and I am sure that my family fulfilment contributed to my vitality.

I leave my rear view mirror to drive steadily and calmly towards the new life before me. I must get ready for another 40 years if I trust my very favourable family statistics. My mother lived up to the age of 90 and my grand father lived up to almost 103. He was longer in retirement than in service. The Retirement Department of NATO isn't ready to forget me.

I am always prepared to drive speedily on all roads in all weather conditions (our regretted Mr Borgeaud had nicknamed me "Speedy Gonzales"), to go up to the higher floors at my children's, to help them.

My conclusion draws inspiration from a song by Charles Trenet [printed on page 53].

Twenty Years Ago

(Extracts from AGARD Highlights 80/1and 80/2 - unfortunately, no similar photographs are available from DRG)

The 1980/1 issue reported the Fall 1979 AGARD Board meeting in Italy, where the Delegates were welcomed by the Honourable Dr Giovanni del Rio, Under-Secretary of Defence, General Alessandro Mettimano, Chief of Staff of the Italian Air Force, Lieutenant General U. Fabi, a National Delegate, and Professor Luigi Broglio, also a National Delegate. Professor Broglio had been involved from the beginning of AGARD, since he represented Italy at the meeting that established AGARD in 1951. He was a National Delegate from 1969 to 1976 and again from 1977 until 1996, was awarded the von Kármán Medal in 1983, and was the first Chairman of the Structures and Materials Panel, and a member of the Fluid Dynamics Panel from 1952. Professor Broglio gave a presentation on the role of Italy in space cooperation, which was reported in Highlights 1980/1 together with two other papers from Italy.

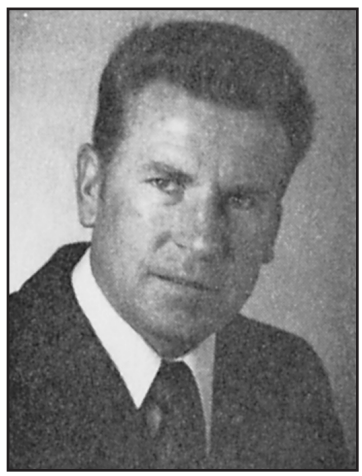
The same issue also reported that Uwe Krogmann, a member of the Guidance and Control Panel, had been awarded the Wolfgang Martini Plakette for 1979, the highest decoration conferred by the German Institute of Navigation. This is of particular interest, since Professor Krogmann has contributed an article to this issue of Highlights (page 12).

General Mettimano

General Fabi (at right) presented a plaque
to the Chairman, Dr Alan Lovelace

Dr del Rio

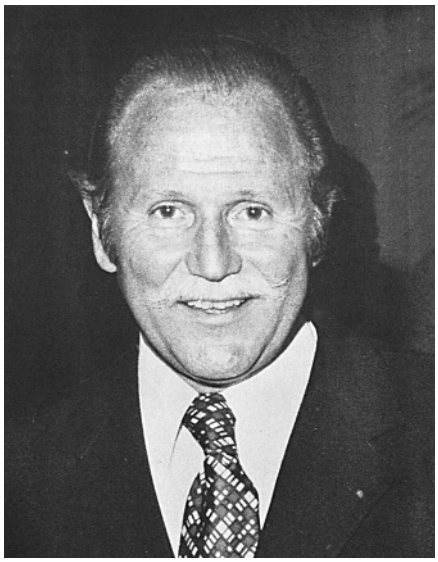
Professor Broglio



Professor Krogmann

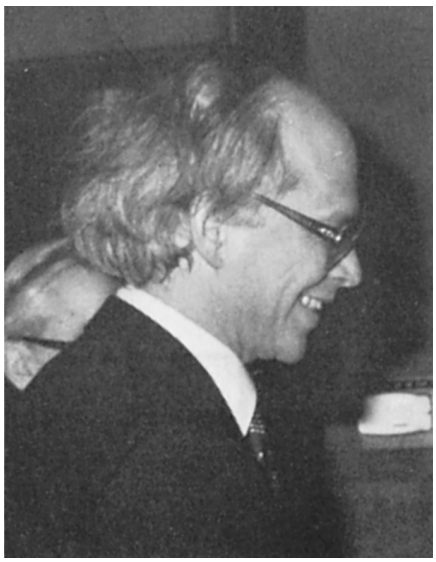
The 1980/2 issue reported two losses of long-standing AGARD staff. The first was the retirement of Rolland Willaume, who had been the main assistant to the founder of AGARD, Dr Theodore von Kármán, during the setting up of the Agency, and had remained thereafter, as Director of Plans and Programmes, for 28 years. He was one of the three recipients of the von Kármán Medal in its first year, 1972. A retrospective on his whole career, including his military service as a fighter pilot during World War 2, was given by the Director of AGARD. On a sadder note, the issue also reported the death of June Merker, who had been Personal Assistant to von Kármán, from 1949 to his death in 1963. She had also acted as Secretary to the Director, the first of only three to date.

The same issue also reported the publication of the second edition of the Multilingual Aeronautical Dictionary, with an article by Axel Tan, Chairman of the Technical Information Panel, describing its preparation, and a photograph of Trevor Sharp, the Publications Executive, holding a copy. The Dictionary is now available on CD-ROM, and a page printed from the CD-ROM version forms the background to these photographs. The CD can be bought from RTA HQ for 250 French francs.

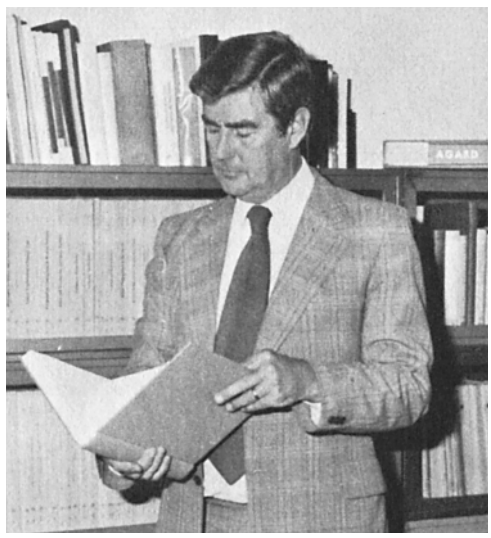


Rolland Williams

June Merker is next to Dr von Kármán; and Dr Frank Wattendorf, Director of AGARD from 1952 to 1963, and later Honorary Vice-Chairman, is on the other side of this photograph taken at the 1955 General Assembly.



Axel Tan



Trevor Sharp

This Really is the End

Drôles d'Idées (voir p. 49)

Cette femme est pensive
Les yeux loin de son bureau
C'n'est pas une oisive
Bien au contraire elle travaille trop.

Alors elle a décidé d'avoir des idées
Des idées d'lagune
Des idées d'Lido
Des idées d'fortune
Et de clairs de lune
Et les pieds dans l'eau

Des idées d'vacances
Et de sac à dos
Des idées de romances
Des idées d'dodo…
Des idées de vivre
De crier bien haut
Que la marche à suivre
C'est c'qui nous enivre
A tire-larigot
Des idées d'gondole

Avec toi Jean-Louis
Quand le coeur s'affole
Et qu'il batifole
Non, y'a plus d'bobo

Des idées d'Chambord et d'Azay
l'rideau
Des idées de décor
Et de son du cor
Des idées d'carosse
De contes de Perrault

Des idées « d'artiste »,
De cirque Medrano
Des idées de piste
Et d'Auguste triste
Nez rouge, godillots

Des idées d'adulte
De foyer gentil
Qui vous catapulte
Dans le doux tumulte
De bébés tout petits.

Oui mais le temps passe
Les voilà grandis
Et devant la glace
On fait la grimace des mamans vieillie

Oui, la terre est ronde
On en fait le tour
Sous les mers profondes
Et les cieux qui grondent
En quatre vingts jours

Mais la belle histoire
C'est celle du futur
D'un voyage de gloire
En quittant un soir
La Terre et l'azur
Un navire spatial

Nous emporte bientôt
Il navigue sans voile
Parmi les étoiles
Avec toi JEAN-LOUIS
Là haut tout là-haut.

Funny Ideas (see p. 50)

This woman is thoughtful
Her eyes looking far away from the office
She is not lazy
On the contrary she works too hard.

Therefore she has decided to have some ideas
Ideas of lagoon
Ideas of fortune
And moonlight
With her feet dipping in the water.

Ideas of holidays and rucksack
Ideas of romance
Ideas of bye-byes
Ideas of life to shout loudly that the rule to be followed is
What makes us tipsy.
Ideas of gondola with you Jean-Louis
When the heart beats hard and plays around there is no more sore.

Ideas of Chambord and Azay le Rideau Castles
Ideas of embellishment and sound of hunting horn
Ideas of state coach and Perrault's fairy tales
Ideas of artist performing at the Circus and sad clown with red nose and big shoes.
Ideas of adult with a dear family who catapult you into the soft hubbub of babies.

Indeed time flies away.
Here they are grown up
And looking in her mirror the elderly mother forces a smile.

Indeed the earth is round
We can travel around the world in very deep oceans and fly under roaring skies within 80 days.

But the beautiful story is the future.
A trip of glory when one night a space vessel takes off and flies away from the earth and skies with both of us aboard.

Without any sail it navigates among the stars higher and higher with you Jean-Louis.

Panels make the news (references to two of our Panels seen recently):

SAS orders six A330-300 and four A340-300

Comment constituter une **SCI**; qui peut entrer dans une **SCI**?

Did they *really* mean that? (texts that don't conjure up quite the ideas that their authors intended):

(a) The headline in Jane's International Defense Review said "Supermodels get ready for war" - and I expected a photo of Naomi Campbell and Claudia Schiffer with their fingernails ready to scratch one another. But alas, it was only a small model aircraft.

(b) A description of a research institute said:

"The results of the research are being presented in humerous national and foreign exhibitions"

(c) The caption to a photograph of a General giving a sports prize to a young officer said:

"I congratulate you, Captain, on your success in spots"

Do you like mathematical problems?

The problem posed here in the last issue (Highlights 1999) created a fair amount of interest. I asked for a non-iterative and non-recursive formula giving the probability that I photographs of a set of N will be in the same positions before and after they are randomly re-ordered. Five people replied, but one of them admitted that he couldn't find a non-recursive formula. The other four all gave me essentially the same (correct) formula, in slightly different forms, and I find it difficult to say which is the most elegant. So I have decided to send them all a bottle of (slightly less good than anticipated) French wine as soon as possible. The winners are (in alphabetic order): Gregorio Ameyugo of Spain, who is currently working in RTA, Heinz Häge of the German Ministry of Defence, Joe May of Canada, the fiancé of our printer's Project Manager, and Clarel Smit of TNO, The Netherlands.

In what I think is the simplest form, the number of combinations with I the same is:

$$\frac{N!}{I!*(N-I)!} * Int\left[\frac{(N-I)!}{e}\right] (+1 \text{ if } (N-I) \text{ is even})$$

Int = 'the integral part of'
e = 2.718281828… [sorry about the typing error last time]

and the probability is the same formula with N! replaced by 1.

I also asked why the number of combinations with one match is always one more than the number with no match (if N is odd) and vice versa if N is even. All four replies included a mathematical proof of this, which is relatively straightforward, but no one gave any reasoning as to why this should be the case, which is what I was hoping for. If anyone would like to pick up this challenge, I should be interested to see their thoughts.

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Imprimé par St-Joseph Ottawa/Hull
(Membre de la Corporation St-Joseph)
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